Research and Farming

1946

Sixty-Ninth Annual Report

Agricultural Experiment Station North Carolina State College of Agriculture and Engineering of The University of North Carolina

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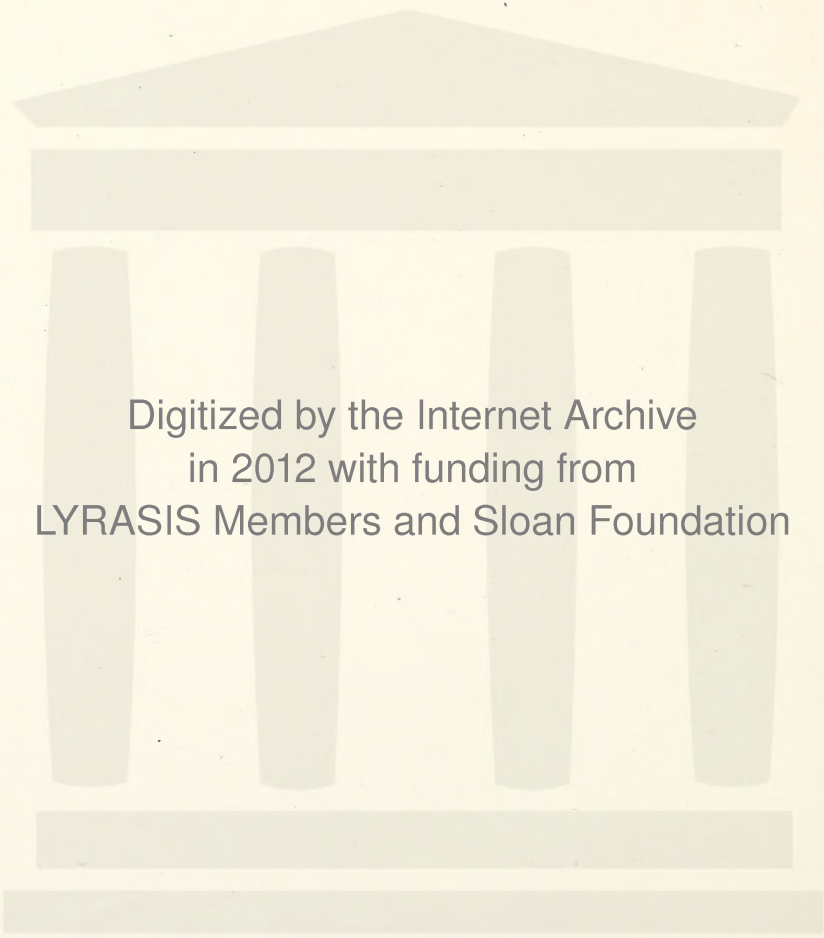

Research and Farming

1946

L. D. BAVER

Dean of Agriculture and Director, Agricultural Experiment Station

SIXTY-NINTH ANNUAL REPORT

Agricultural Experiment Station North Carolina State College of Agriculture and Engineering of The University of North Carolina Fiscal Period July 1, 1945-June 30, 1946 Progress Report for Dec. 1, 1945 to Nov. 30, 1946, Raleigh

Volume V *Progress Report No. 4*

State Institutions Cooperating In Agricultural Research

STATE COLLEGE OF
AGRICULTURE AND ENGINEERING
OF THE
UNIVERSITY OF NORTH CAROLINA

FRANK P. GRAHAM, *President*

J. W. HARRELSON, *Chancellor*

L. D. BAVER, *Dean of Agriculture*

N. C. DEPARTMENT OF AGRICULTURE
RALEIGH, N. C.

W. KERR SCOTT, *Commissioner*

F. E. MILLER, *Director of Branch Stations**

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* The six branch station farms are owned and operated by the North Carolina Department of Agriculture, and the employees on these farms are members of the Department of Agriculture staff.

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To the Governor of North Carolina, the Board of Trustees and President of the University of North Carolina and the Chancellor of the North Carolina State College of Agriculture and Engineering:

I am transmitting herewith the report of the Agricultural Experiment Station for the year ending June 30, 1946.

Respectfully submitted,

L. O. Baver

Director,
NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION.

AGRICULTURAL ENGINEERING

FIRE LOSS IN BRIGHT LEAF TOBACCO CURING BARNS

A survey made cooperatively with the State College Extension Service revealed a fire loss of 1,412 tobacco barns in North Carolina in 1946—approximately 5.6 barns out of every thousand were destroyed by fire. **(Fig. 1).**

Cause of fire varies with fuel used. Coal and wood-fired barns are hazardous because of falling sticks and leaves, and because building materials are too close to the furnace or flues, while oil-fired barns show greater losses from defective burners and installations and from flooding oil. Open flame oil burners as a type showed less fire hazard than other types, although some individual burners in other types showed fire safety records nearly as good as those of open flame oil burners.

Peak fire losses occurred in tobacco barns at 11 a.m. and 4 p.m., reflecting those periods when barns are excessively fired and left unattended.

The greatest number of fires—712—occurred at temperatures of 160 through 179 degrees, while a significant number—373—occurred between 130 through 159 degrees, showing that although the tobacco leaf itself is not dangerously combustible, danger exists in heavy firing without adequate fire protection design in the tobacco barn.

TOBACCO CURING FUEL COSTS CAN BE REDUCED

Two new tobacco curing barns were built at the Oxford Branch Station for conducting research in tobacco curing. The barns, one of which is pictured in **Figure 2** were constructed alike.

The foundation is of concrete blocks. The wells are ¾ inch pine lumber, double thickness, with a layer of 1-ply, waterproof building paper between the two layers of board. The roof is sheathed with ¾ inch pine boards and covered with asphalt-slate-coated roofing. The barns have stokers and furnaces alike.

The first cures in the two barns were made with the barns as described above. No. 1 barn used 2,434 pounds of coal for the cure, in 115 ¾ hours. No. 2 barns used 2,404 pounds of coal for the cure in 115 ½ hours.

The following changes were made in barn No. 2: **(Fig. 3)**

Cure 2. The ventilation openings around the eaves were stopped.

Cure 3. Draft controls were put on the flues.

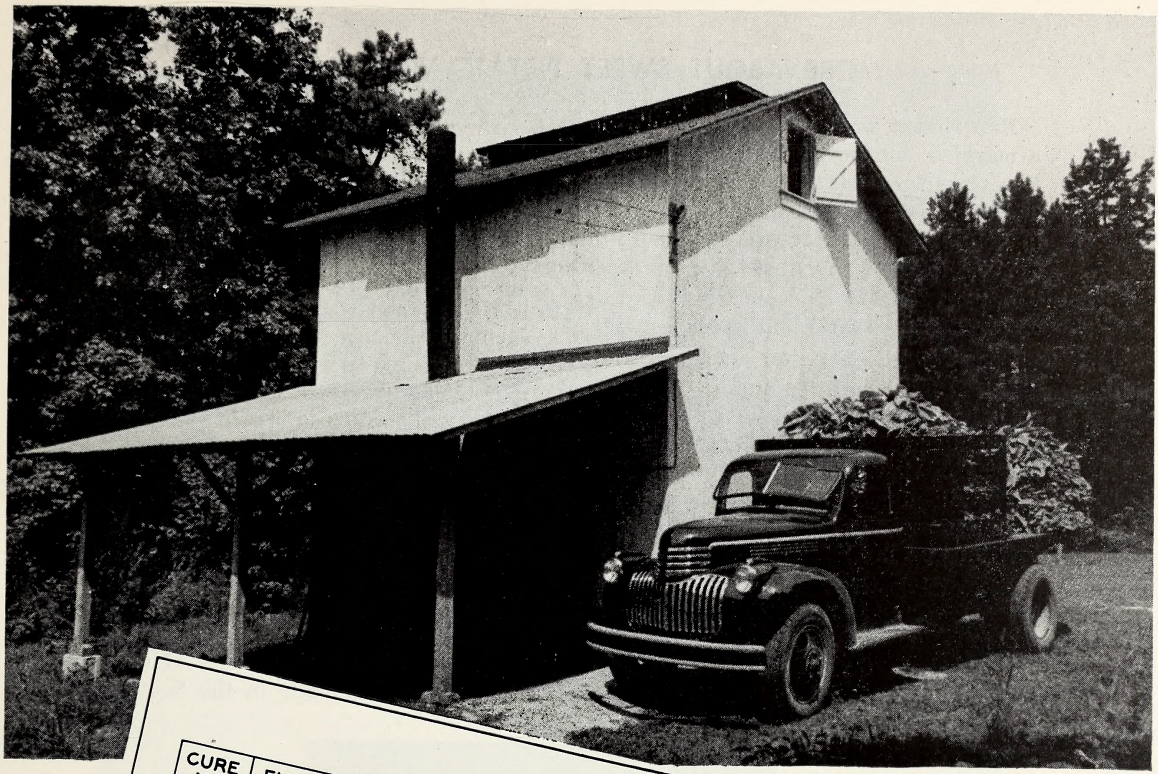
Cure 4. The barn was insulated to the plate with 2-inch fireproofed cotton insulation. **(Fig. 4)**

Cure 5. The ventilators at the bottom of the barn were closed by filling them with glass wool and by lowering the sheet metal ventilation doors.

After these changes were made in barn No. 2, the following results were obtained: Barn No. 1, used 1,989 pounds of coal for the cure in 107 7/12 hours. Barn No. 2 used 820 pounds of coal in 95 11/12 hours.

The tests on the two barns were made with the tobacco from the field divided stick by stick. The tests were started at the same time and the tobacco cured as nearly alike as possible.

FIG. 1. TOBACCO BARN FIRES ARE EXPENSIVE

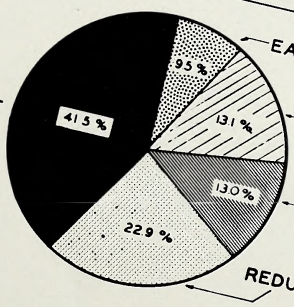


G. 2. FUEL
ONSUMP-
ON TEST
ARN AT
XFORD,
C.

CURE NO.	FUEL USED - LBS COAL	
	CONTROL	TEST
1	2434	2404
2	2338	2118
3	2254	1743
4	2399	1545
5	1989	820

TESTS CONDUCTED ON BARNS AS NEARLY IDENTICAL AS POSSIBLE BY U.S.D.A., BUR. PLANT IND., SOILS. & AG. ENG., N.C. STATE DEPT. AGR., AND N.C. STATE COLLEGE AGR. EXPT. STA. JULY AND AUG., 1946

THE TEST BARN USED 1169 (58.5 %) POUNDS LESS COAL THAN THE CONTROL ON THE 5TH CURE



EAVES CLOSED (NO. 2)

DRAFT CONTROLLED (NO. 3)
2-12" AUTOMATIC DRAFT CHECKS

INSULATED (NO. 4)
1½" COTTON BATTING TO PLATE LEVEL

REDUCED BOTTOM VENTILATION (NO. 5)

FUEL SAVING ACCOMPLISHED IN TOBACCO CURING IN 1946 TESTS

SEPT. 1946

OXFORD, N. C.

G. 3.

MORE ABOUT SWEET POTATO VINE HARVESTER

Experiment work has been completed on a machine for the harvesting of sweet potato vines for feed. In North Carolina alone 64,000 acres of sweet potatoes were grown in 1946. If means were provided, more than 600,000 tons of green vines excellent for silage or 180,000 tons of dehydrated feed of excellent quality could have been saved.

The 1945 experimental machine[1] was redesigned for simplicity and quality of construction and to lend itself to good manufacturing procedure. The top picture in **Figure 5**, shows the 1946 model with the knives and finger wheels raised for transportation and the bottom picture shows the tools in working position.

Field trials throughout the State during the 1946 season proved the machine to be successful under practically all conditions except where the field is very weedy or rocky.

The two sets of knives shown in the fore part of the machine cuts the vines loose from the tubers. It was found that mower knife sections were the most satisfactory for this purpose. These knives are inexpensive and may be purchased at any implement or hardware store. The knife holder is so designed that the knife section may easily be removed by a simple lever, no wrench or tool is required. The knife section may then be reversed when dull or replaced with a new one. To do a satisfactory job the knives need to be changed about every half acre.

Since the machine windrows the vines in the valley between the rows, it not only makes possible the saving of the vines for feed but also the possible use of a mechanical digger because the vine removal problem has always interfered with digging. The more than 650,000 acres of sweet potatoes grown annually in the South makes

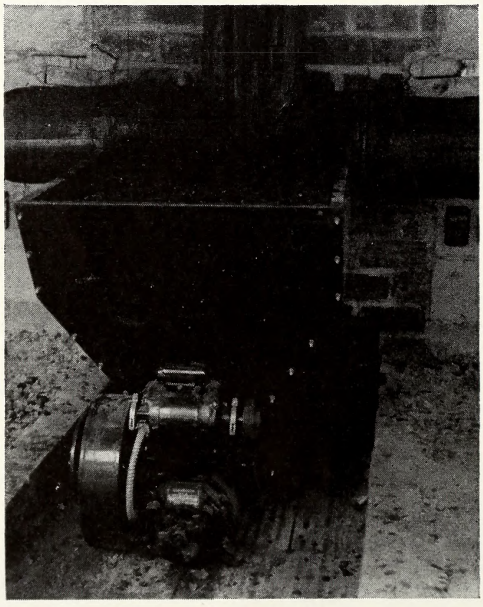


FIG. 4. DETAIL OF AUTOMOBILE DRAFT CONTROL INSTALLED FOR CURE 3 AND METHOD OF CLOSURE OF THE BOTTOM VENTILATORS FOR CURE 4.

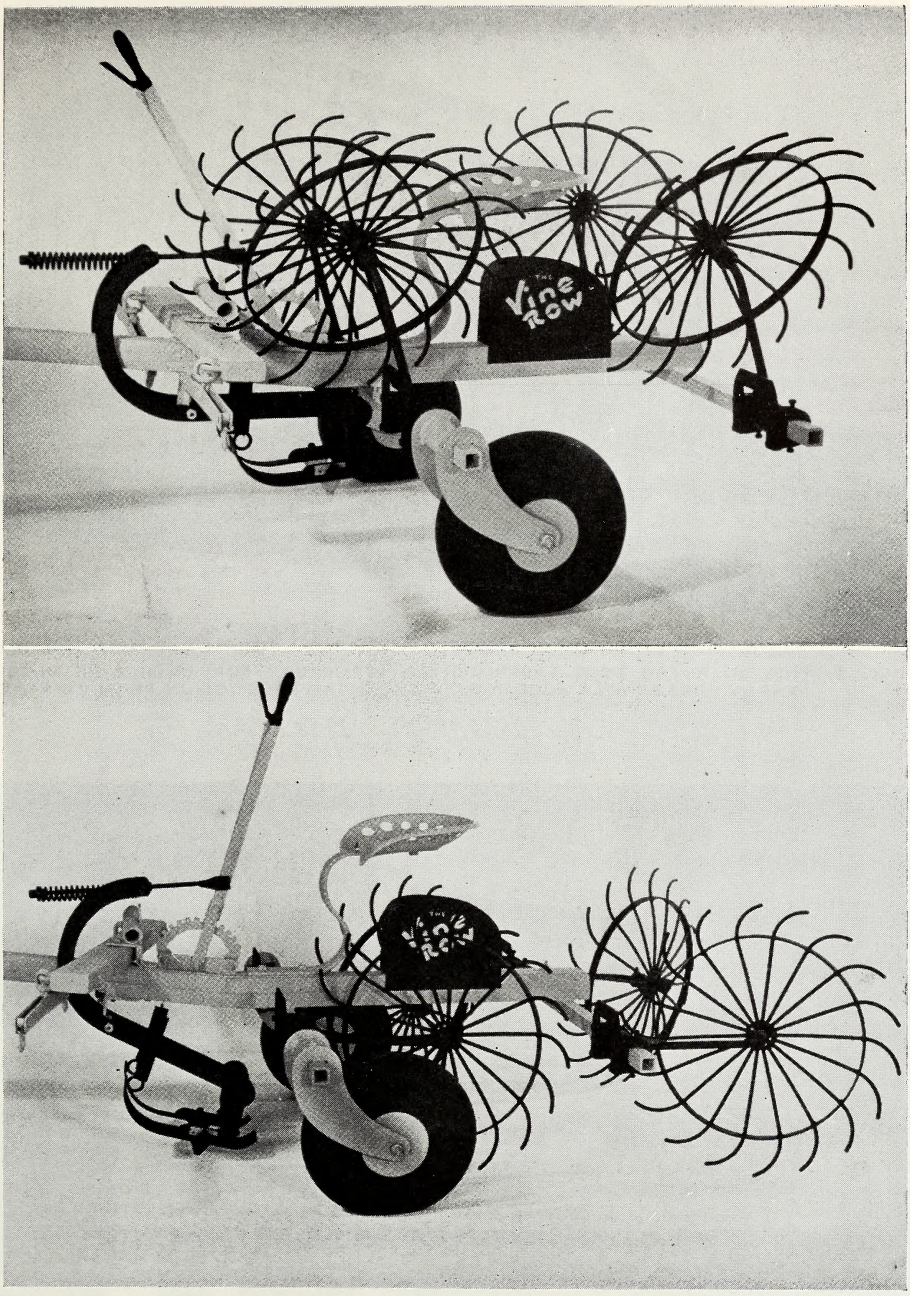


FIG. 5. THE SWEET POTATO VINE-ROW HARVESTER.

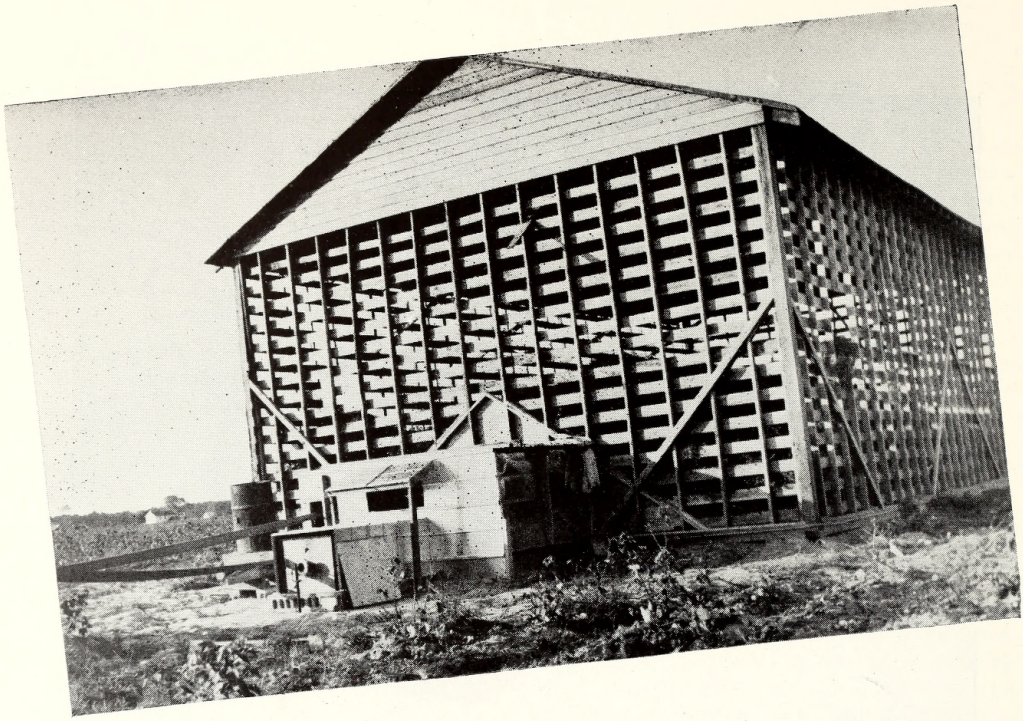


FIG. 6. THIS 30 BY 60 FOOT EXPERIMENTAL STRUCTURE FOR DRYING PEANUTS AND PEANUT FORAGE WILL ACCOMODATE THE TOTAL PRODUCTION FROM 25 ACRES.

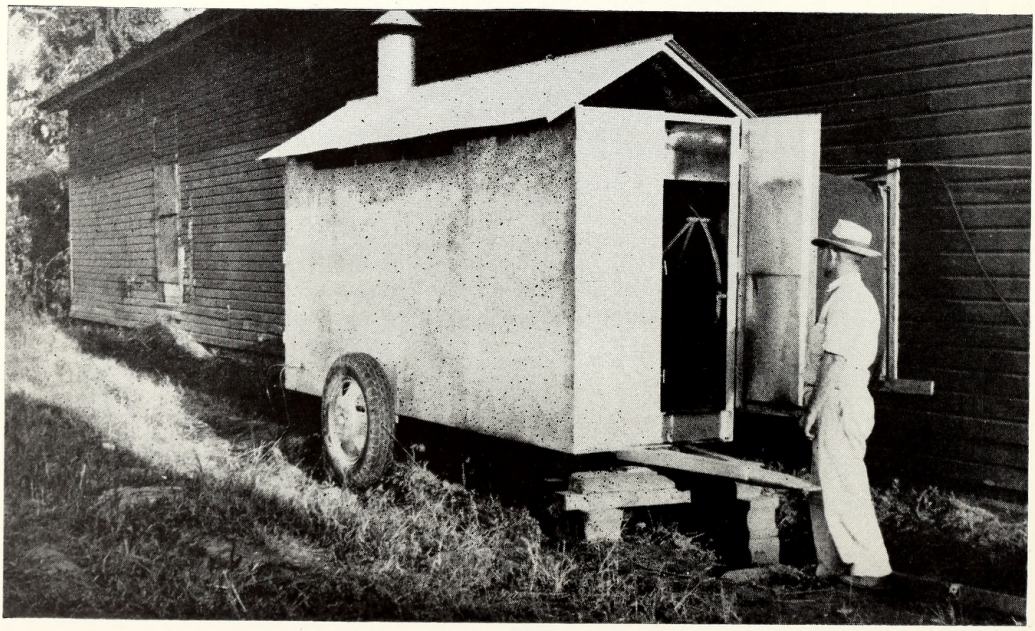


FIG. 7. THE EXPERIMENTAL PORTABLE DRIER WAS CONSTRUCTED AND USED SUCCESSFULLY FOR DRYING HYBRID CORN SEED AND BULBS IN 1946. WHEN FULLY DEVELOPED IT WILL PROVIDE FORCED HEATED AIR FOR DRYING HAY, SMALL GRAINS AND OTHER CROPS.

it one of the most important crops. Mechanization of the harvest would result in tremendous savings in both labor and power.

Arrangements have been made to place this machine in the hands of a manufacturer.

ARTIFICIAL DRYING OF PEANUTS SEEMS GOOD

There is a strong possibility that by using artificial drying the quality of peanuts and peanut forage can be improved and labor requirements reduced.

The peanuts and forage from 19.3 acres were dried during October, 1946, in an experimental drier **(Fig. 6)** constructed in cooperation with B. W. Evans of Edenton. It was found that this 30 by 60 foot drying building would normally accommodate all the forage and nuts from 25 acres for drying at one period. By planting some of the crop early, and some later, it might be possible to dry two or three lots each season. If so, this drying building would handle all the forage and nuts from 50 to 75 acres.

The moisture content of the forage ranged between 56 and 61 per cent and that of the nuts ranged between 45 and 65 per cent when placed in the drier four days after digging. After 10 days of drying the moisture content of the forage was down to 15.4 per cent and that of the nuts was 16.2 per cent. During the drying period air was forced continuously through the forage and nuts at a rate of about 18 cubic feet per minute per square foot of floor area. An experimental oil-burning heater was constructed to provide supplemental heat to the drying air. This heater was found capable of raising the intake air temperature 13° F. and was operated every night and two days when rain or foggy weather prevailed. The fuel and power cost for drying was estimated to be $4.74 per acre.

1 See 1945 "Research & Farming" for a description of the machine.

SUCCESSFUL PORTABLE CROP DRIER

Some farmers are interested in equipment for drying one or more crops at different locations. An experimental unit **(Fig. 7)** was constructed in cooperation with Walton Broome of Aurora. This unit consists of an oil-burning heater with a fan to provide forced air. It has a capacity of from 20 to 30 thousand cubic feet of air per minute increased in temperature by 30 to 40° F. While further refinement is needed it has been used successfully for drying hybrid corn seed and bulbs.

In August, 1946, a total of 1,620 bushels of hybrid corn seed was dried with this portable drier. The moisture content of the ears was reduced from 33.1 per cent to 10.5 per cent by drying with air temperature about 100° F. The power and fuel cost for drying amounted to 8.2 cents per bushel.

FIELD CROPS

CORN

T5109 PROMISING NEW WHITE HYBRID

T5109 is the new white corn hybrid which will be released jointly in 1947 by the Tennessee and North Carolina Agricultural Experiment Stations. The new hybrid has been widely tested during 1945 and 1946. In seven experiments located across the Piedmont and Coastal Plain in North Carolina during 1946, T5109 averaged 95.3 bushels as compared to Tennessee 10 average of 82.7 bushels, and 68.3 bushels per acre for the best white open pollinated variety. T5109 produced over 100 bushels per acre in four out of the seven locations. These were: Guilford County, 117.7 bushels; Currituck County, 116.7 bushels; Camden County, 113.5 bushels; and Cleveland County, 104.4 bushels. (Fig. 8) Tests conducted in Tennessee and Mississippi also demonstrate the high productivity of this new hybrid.

T5109 is very similar to Tenn. 10 and is well adapted wherever the latter hybrid is adapted. The new hybrid generally produces more grain, especially on very productive soil, has more uniform plants and ears, has better husk coverage which tends to make it more resistant to insect damage, and has harder grain than Tenn. 10. The new hybrid will stalk break under some conditions similar to Tenn. 10.

DEMAND FOR HYBRID SEED STILL AHEAD OF SUPPLY

Over 12 per cent of the corn acreage in 1947 can be planted with North Carolina Certified Hybrid seed. This is possible because members of the N. C. Crop Improvement Association produced an estimated 50,000 bushels of hybrid seed corn in 1946. Farmers show increasing interest in the use of good adapted corn hybrids.

The N. C. Foundation Seed Producers, Inc., can furnish the foundation single cross seed to growers to again double the supply of hybrid seed corn during 1947, provided the seed growers are able to expand their production to utilize fully all the supply.

During the 1946 season the following acreage by hybrids were grown:

Hybrid	Acres
N. C. 26	800
N. C. 27	100
N. C. T 11	235
N. C. T 23	200
N. C. 1032	85
N. C. 1111 (white)	30
N. C. T 20 (white)	80
U. S. 282	95
Tenn. 10 (white)	60
Total	1,685

Of these nine hybrids, N. C. 27 has shown the greatest promise as an all-purpose corn for the southeastern half of the state. N. C. 27 **(Fig. 9)** combines high yield of grain, good strength of roots and stalks, good husk coverage over ear tip, good grain quality and good insect resistance.

DON'T SAVE SEED FROM HYBRID CROP

Experiments with local corn hybrids have shown the second generation seed to be very inferior to the first generation hybrid seed.

Seed saved from N. C. hybrids 1111 and 1032 produced only 51 per cent and 76 per cent, respectively, as much grain as did new hybrid seed of the same hybrids. Second generation hybrid seed of the hybrid N. C. T11A averaged 89 per cent of first generation seed during the past two seasons. Six single cross hybrids grown during 1946 to compare the first generation seed with the second generation seed averaged only 56 per cent as much grain in the second generation as the first generation. **(Fig. 10)** All these results indicate that North Carolina farmers who save seed from a general hybrid corn field will sacrifice much in their general production as compared to obtaining newly made hybrid seed each year. The use of second generation foundation seed stocks should also be avoided in the production of hybrid seed where maximum production of both pollen and grain are essential to high quality hybrid seed.

HIGH RATES OF FERTILIZATION AND THICK PLANTING INCREASE SEED STOCKS

Aiding greatly in getting the new corn hybrids into large-scale production are the experiments with fertilization and spacing of inbred lines of corn. The production of foundation seed has increased on a per acre basis during each of the last three years. In 1944 the average production on 20 acres of inbred plantings was only 175 pounds of seed; in 1945 on 40 acres average production was 450 pounds; and in 1946 on 41 acres average production was 700 pounds of seed. A typical inbred increase field is shown in **(Fig. 11)** which was planted in rows 3 feet apart and plants spaced 12 inches apart in the rows.

In an experiment grown in Johnston County in 1946 three inbred lines averaged 1,038, 1,669, 1,904 and 2,345 pounds of grain per acre on plots which had received 20, 60, 100, and 140 pounds of nitrogen per acre, respectively, with 10,500 plants per acre. The average yields of the three inbred lines were 2,345, 2,430, and 2,534 pounds of grain per acre with 10,500, 13,300 and 16,400 plants per acre, respectively, where all plots received 140 pounds of nitrogen per acre. The maximum yield (3,286 pounds of grain) from inbred lines was produced on plots receiving 140 pounds of nitrogen, 16,400 plants per acre and mulched with building paper after the last cultivation.

NITROGEN INCREASES CORN YIELDS CONSISTENTLY

Corn has responded to nitrogen in nearly all the fertilization experiments conducted during the past three years. A good example of the growth response to nitrogen is shown in **Figure 12** where the yield was increased 86 bushels by the application of 180 pounds of nitrogen per acre. In 1946 the average yields in 13 experiments were 34, 59, and 94 bushels per acre from plots receiving adequate phosphoric acid and potash and 0, 40, 80, and 120 pounds of nitrogen per acre, respectively. In all 38 experiments conducted during the past three years the average yields from these same treatments were 28, 50, 68, and 78 bushels per acre, respectively.

Even where an excellent growth of winter legumes was turned under there was still a substantial response to nitrogen. In three cover crop experiments, corn following Austrian winter peas yielded 53, 81, and 92

FIG. 8. EARS SHOWN ARE OF HYBRID T5109 HARVESTED FROM A 60-PLANT PLOT WHICH PRODUCED AT THE RATE OF 100 BUSHELS PER ACRE AS COMPARED TO 72 BUSHELS PER ACRE FOR WEEKLEYS IMPROVED GROWN IN THE SAME TEST ON THE TOBACCO BRANCH STATION, OXFORD, N. C. 1946.

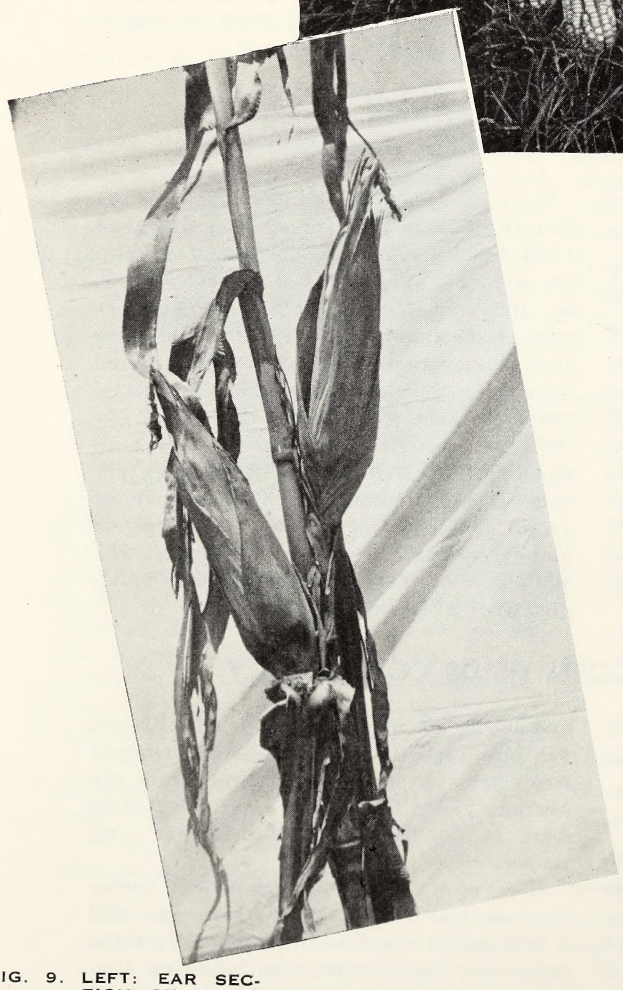


FIG. 9. LEFT: EAR SECTION OF PLANT OF HYBRID N. C. 27 SHOWING GOOD HUSK COVERING OF EARS. RIGHT: SAME PLANT WITH HUSK PULLED BACK TO SHOW GRAIN CHARACTERISTICS AND EAR TIPS FREE OF WORM DAMAGE.

bushels per acre without additional nitrogen. Where 80 and 90 pounds of nitrogen per acre was applied in addition to the nitrogen supplied by the winter legume, the yields were 66, 104, and 114 bushels per acre, respectively.

NITROGEN FERTILIZATION BOOSTS PROTEIN IN GRAIN

Nitrogen applications had a marked influence on the protein content of the corn grain in all 25 of the experiments conducted in 1944 and 1945. The size of the increase in protein was usually the greatest where the yield response to nitrogen was the lowest and vice versa. This relationship is shown in a test where, under excellent moisture conditions, the yield response to nitrogen was exceptionally good and the increase in protein percentage was relatively low. However, under the droughty condition yields were limited by a lack of moisture, but the protein content continued to increase. In another experiment **(Fig. 13)** there was no yield response beyond the 120-pound nitrogen application. However, the protein percentage was substantially increased by an additional 40-pound nitrogen application. In this experiment leaf disease which occurred at the late roasting ear stage destroyed much of the leaf tissue and apparently retarded further carbohydrate manufacture, while nitrogen uptake and protein manufacture continued.

The nitrogen content of corn grain in all the experiments varied from a low of 0.92 per cent to a high of 1.99 per cent, or an approximate range of 5.8 per cent to 12.5 per cent protein. Although corn is not sold primarily for its protein content, substantially smaller amounts of high priced protein concentrates would be required by hogs or poultry fed corn containing 11 to 12 per cent protein than by those fed corn with 6 to 7 per cent protein.

The phosphorus and potash content of the grain was not appreciably changed by fertilization.

NITROGEN LEVEL GOVERNS SPACING

The degree to which fertilization and weather conditions influence the yield at various plant spacings is shown in **Figure 14.** At high nitrogen levels and with adequate rainfall, increasing the plant population from 4,000 to 10,000 plants increased the per acre yields about 50 per cent. At the low nitrogen levels where only 20 or 30 pounds per acre of nitrogen were used, the average yields were not changed by increasing the population up to 10,000 plants per acre. In fact, the wide spacings, 4,000 to 7,000 plants per acre, were more desirable at the low fertility level because of better ear size.

Even under droughty conditions yields were increased slightly by the use of closer spacings when adequate fertilization was provided. Thus, it appears that when adequate nutrients were supplied, corn can be planted thicker (about 10,000 plants per acre) so as to make more effective use of soil moisture in favorable seasons, without fear of yield reduction in droughty seasons.

Four thousand plants per acre is the conventional stand in some sections of the state. It has been interesting to note the differences in weed growth in these plots as compared to thicker plants, particularly at locations where wet seasons were encountered. The corn in all plots was practically free of weeds at "laying by" time (about 2½ feet high). However, by roasting ear time the plots with 4,000 plants per acre had a solid cover of weeds (mainly cocklebburs) about hip high, while only a few small weeds were present in the thickly planted corn because it was able to compete favorably with the weeds until the corn was "made."

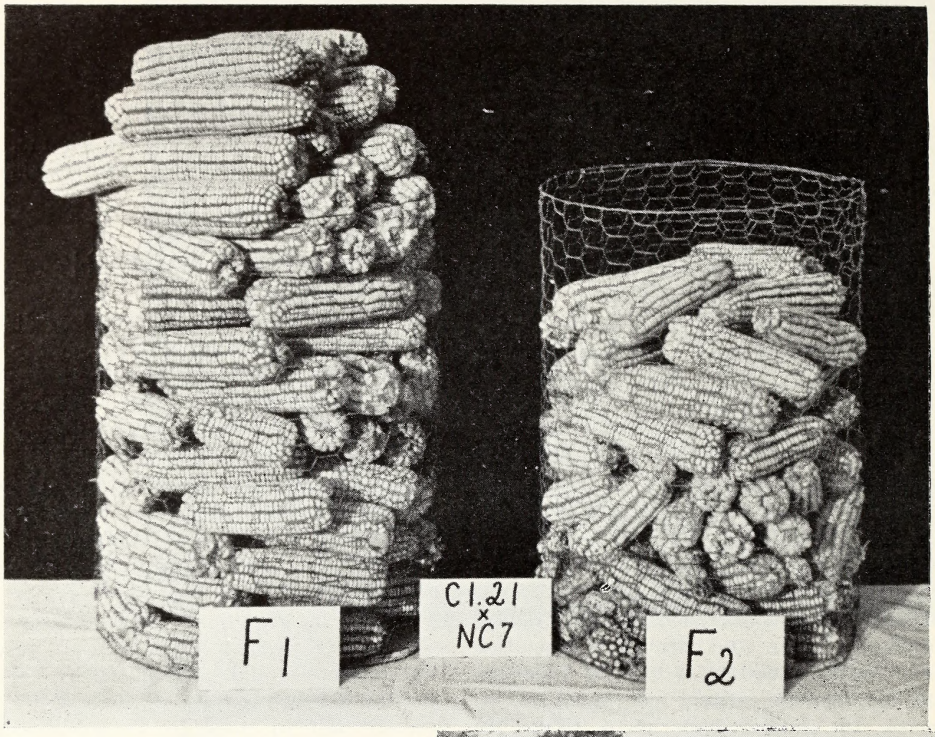


FIG. 10. THE EAR SAMPLES SHOWN WERE HARVESTED FROM PLOTS OF EQUAL SIZE AND HAVING EQUAL NUMBER OF PLANTS. LEFT: F1 OR FIRST GENERATION WAS FROM PLOT PLANTED TO NEW HYBRID SEED. RIGHT: F2 OR SECOND GENERATION WAS FROM PLOT PLANTED WITH SEED SAVED FROM A HYBRID CROP. THE SECOND GENERATION PLOT PRODUCED ONLY 56 PER CENT AS MUCH GRAIN AS THE FIRST GENERATION PLOT.

FIG. 11. AN INCREASE FIELD OF INBRED NC7 IS SHOWN. NOTE EXTREME UNIFORMITY OF THE PLANTS IN THIS FIELD. INBRED NC7 IS USED IN THREE N. C. CERTIFIED HYBRIDS, N. C. 26, N. C. 27, AND N. C. 1032, TO GIVE A STRONG ROOT SYSTEM.

LOWER AMOUNTS OF DDT EFFECTIVE AGAINST CORN EARWORM

Several methods were tested for control of earworms on sweet corn. It was found that oiling the silks with a white oil containing 0.25 per cent DDT gave about as good results as 2 per cent DDT in white oil, which had been tested the previous year with excellent results.

The most interesting results, however, were obtained in tests with DDT sprays made from either wettable powder or miscible oil in water at a concentration of 0.25 per cent DDT. Both sprays gave control almost as good as the oil treatment in some of the experiments. The sprays were applied with a compressed air, hand sprayer using either a disk nozzle or a solid stream jet nozzle. The jet nozzle gave better control, which was attributed to the deeper penetration into the silks. Ears treated with these sprays did not have the objectionable oiliness produced by the oil treatment.

Dusting the silks with 3 per cent DDT dust gave poorer control than spraying but still protected a large proportion of the ears. Considering the ease of treatment, DDT dusting has merits when the earworm population is naturally low.

FIG. 12. NITROGEN MADE THE DIFFERANCE. THE CORN ON THE RIGHT RECEIVED 500 POUNDS OF A COMPLETE FERTILIZER PLUS 160 POUNDS PER ACRE OF NITROGEN SIDEDRESSING AND YIELDED 110 BUSHELS PER ACRE. THE CORN ON THE LEFT RECEIVED THE SAME AMOUNT OF PHOSPHORIC ACID AND POTASH BUT THE NITROGEN WAS OMITTED. IT YIELDED ONLY 24 BUSHELS PER ACRE.

SOIL TREATMENTS EFFECTIVE FOR SOUTHERN CORN ROOTWORM

Sweet corn was successfully protected from the ravages of the corn rootworm or "budworm" in several experiments conducted in badly infested soil in the spring of 1946. In the first experiment two of the new organic insecticides, DDT and hexachlorocyclohexane, were used to treat the soil just before planting the seed. Both materials were used in a diluted dust form and mixed into the soil with a hoe. The corn was planted in hills, four grains to each hill. After thinning to two plants per hill the treated rows had from 88 to 100 per cent of a perfect stand compared to 40 to 50 per

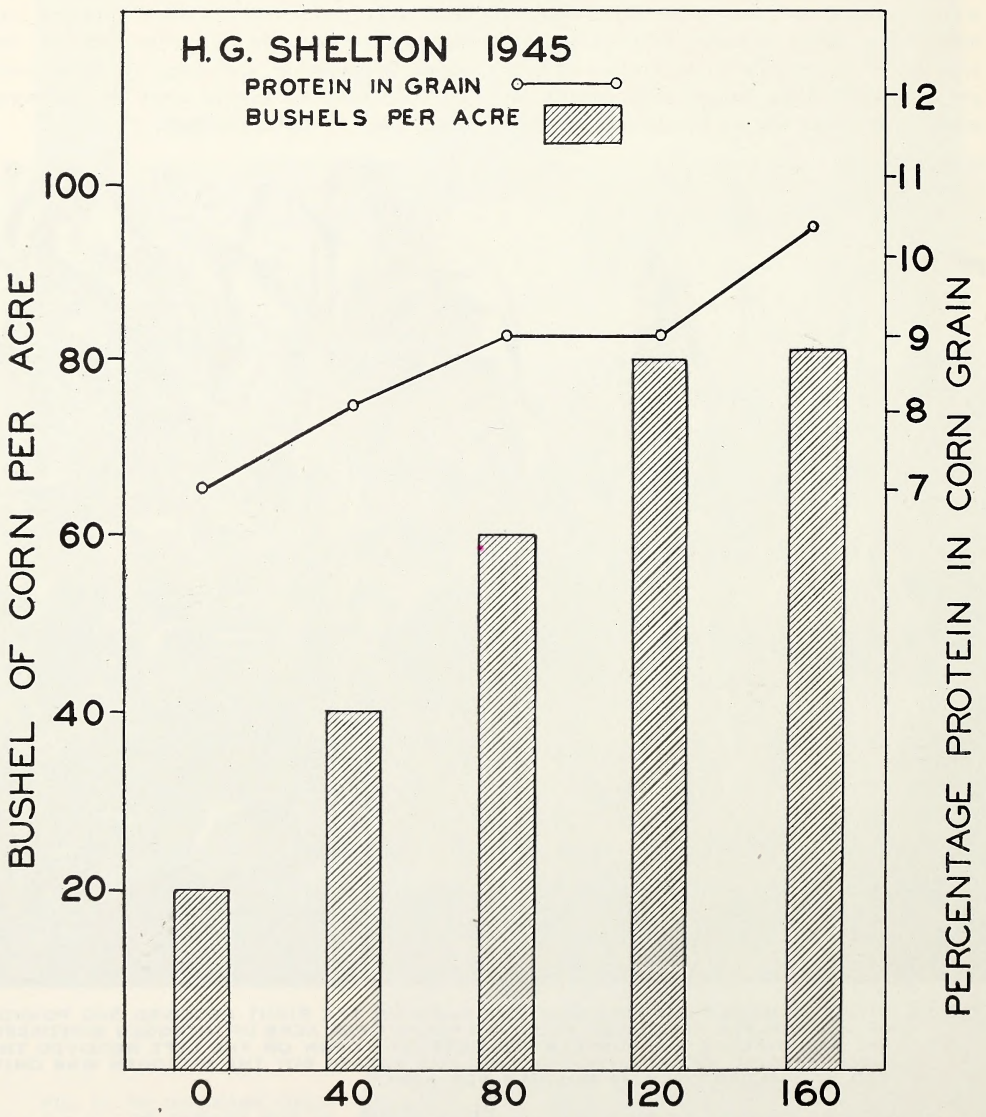


FIG. 13. THE EFFECT OF NITROGEN ON CORN YIELDS AND PROTEIN CONTENT OF CORN GRAIN, IN AN EXPERIMENT CONDUCTED ON NORFOLK FINE SANDY LOAM, H. G. SHELTON FARM, EDGECOMBE COUNTY. ALL PLOTS RECEIVED PHOSPHORIC ACID AND POTASH. N. C. HYBRID 1114 WAS SPACED 16 INCHES APART IN A 3.5 FOOT ROW PROVIDING 9,300 PLANTS PER ACRE.

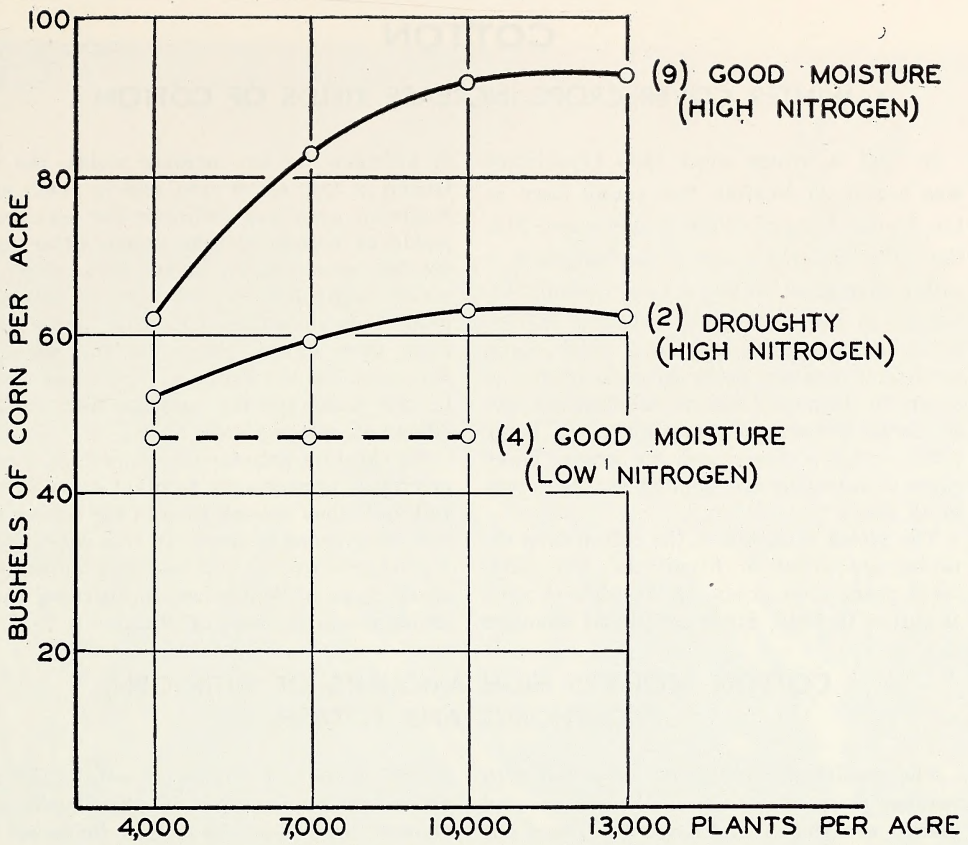


FIG. 14. THE EFFECT OF PLANT POPULATION UPON CORN YIELDS UNDER VARYING LEVELS OF NITROGEN FERTILIZATION AND SOIL MOISTURE CONDITIONS, 1944, 1945, AND 1946. (NUMBER IN PARENTHESIS INDICATES NUMBER OF EXPERIMENTS INCLUDED IN THE AVERAGE.)

cent in the untreated rows. The plants in the treated rows were also of considerably larger size than in the untreated rows.

In a later experiment the two insecticides were used as diluted sprays, applied to the soil around the corn plants when they were two or three inches high. At some of the dosages used, further damage by root-worms was stopped.

However, tests with both insecticides in June showed that young corn plants may be injured by hexachlorocyclohexane. In the case of DDT, there appears to be a wide margin of safety. No injury was observed at double the highest dosage used in the first experiment.

COTTON

WINTER COVER CROPS INCREASE YIELDS OF COTTON

In 1941 a winter cover crop experiment was begun on Norfolk fine sandy loam at the Upper Coastal Plain Experiment Station. Two rotations are being compared, a cotton-corn rotation and a cotton-peanut rotation. In the cotton-corn rotation the effects of Austrian peas, hairy vetch, oats-vetch and oats are being compared with no cover. In the cotton-peanut rotation the cover crops tested are Austrian peas, hairy vetch, crimson clover and rye grass. Three rates of nitrogen are applied on the cotton in all cases.

The yields of cotton in the cotton-corn rotation are given in **Figure 15.** The oats-vetch cover crop produced the highest yield of cotton in 1946. Since additional amounts of nitrogen did not increase yields, the nitrogen in this cover crop and in vetch and Austrian peas was sufficient for maximum yields of cotton. Cotton grown after oats yielded considerably more than with no cover, regardless of the rate of nitrogen used. This indicates that cover crops may have more effects than just the nitrogen furnished by the legumes. The cover crops in the cotton-peanut rotation had similar effects on cotton yields.

To obtain a satisfactory growth of a cover crop it is necessary to plant early in the fall and allow enough time in the spring for the cover crops to grow. In this experiment a good growth was obtained by planting the cover crops in September and turning them under the latter part of March.

COTTON REQUIRES HIGH AMOUNTS OF NITROGEN, PHOSPHORUS AND POTASH

The results of fertilization of cotton with various rates of nitrogen, phosphorus and potash are shown in **Figure 16.** These are two-year data from continuous cotton plots. When one nutrient was varied the other two nutrients were kept constant at what was thought to be an adequate level.

On Norfolk sandy loam, cotton yields continued to increase to the highest rate of nitrogen, 60 pounds per acre (equivalent to 375 pounds of nitrate of soda). The response to applications of phosphoric acid showed that yields of cotton increased to the highest rate. On the Cecil soil, 35 pounds of nitrogen was sufficient. There was no increase above 100 pounds of phosphoric acid on this soil. Sixty pounds of potash was adequate on the Norfolk soil while 90 pounds gave the highest yield on the Cecil sandy loam.

FACTORS AFFECTING YIELD AND QUALITY OF COTTON

There are a number of factors which influence the yield and quality of cotton, some of which are inherited, others are environmental. Yield and quality are, therefore, determined by a combination of inherited characters and weather and soil conditions. Inherited characters that influence yield are bolls per acre, lint percentage, size or weight of boll, and number of seed per boll. Bolls per acre was found to be the most important single factor contributing to yield, with number of seed per boll and weight of lint per boll also influencing yield to some extent. A high percentage of lint is also important. A commercial variety producing a high yield of lint seldom has a low lint percentage.

Differences in rainfall, temperature, soil

type and fertility influence those characters which contribute to yield. For example, 36 seed stocks were grown at both McCullers and Statesville in 1946 under quite similar fertility conditions. Rainfall was above normal at McCullers but very low at Statesville during July, August, and September. Yields at Statesville were approximately 30 per cent lower than those at McCullers. This reduction in yield, apparently caused by drought, was accompanied by a 22 per cent reduction in number of bolls and 14 per cent fewer seed per boll. Higher lint percentages were obtained at Statesville, as is usually the case during a dry season, offsetting to some extent the lower yields of seed cotton. The staple was longer and finer at McCullers but not so strong as at Statesville. The strongest fiber is usually produced when the rainfall is below normal.

FIND HYBRID VIGOR IN COTTON

First generation hybrids between eight lines of the Coker 100 and 200 types produced definitely higher yields of seed cotton and more bolls than the average of their respective parents in 11 of the 28 hybrids studied, and four of these produced higher yields and more bolls than their best parent. Increases in yields ranged from 22 to 35 per cent above the average of their parents. The eight parents were not radically different, but showed some variation in plant size and type, number and size of bolls, and other characters. A commercial variety usually shows some range in type, in some cases probably approaching the range found between these parents. Natural crossing within a commercial variety should, therefore, be beneficial as it would increase fruiting vigor. However, care should be taken to prevent crossing with inferior varieties.

NEW INSECTICIDES PROMISING FOR BOLL WEEVIL CONTROL

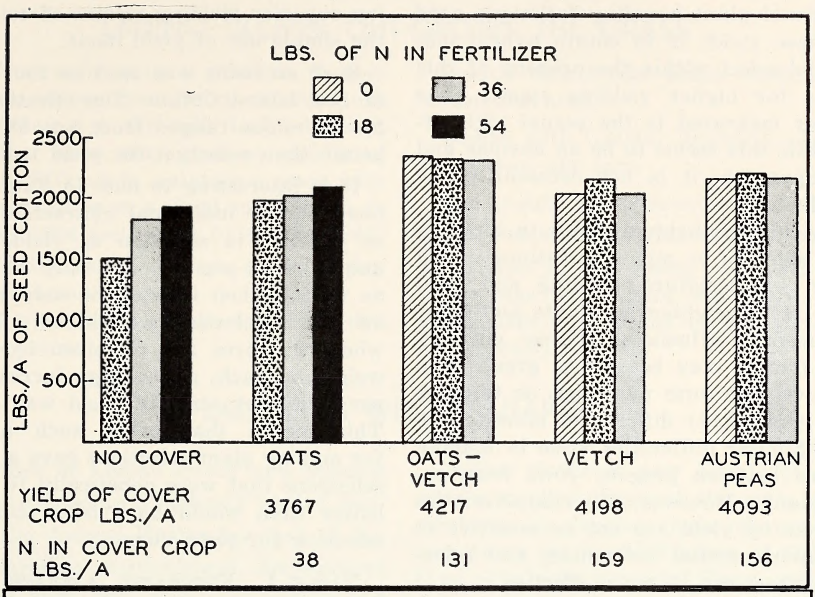
Preliminary tests indicate that benzene hexachloride is very effective against boll weevils but that it does not have any prolonged residual effect. Benzene hexachloride is more effective against the cotton boll weevil than is DDT but it is not as poisonous to the cotton boll worm as is DDT. Therefore, a combination dust of benzene hexachloride and DDT may prove an ideal insecticide for these two pests as well as other cotton insect pests.

DEVELOP GREATER FIBER STRENGTH THROUGH HYBRIDS

When Upland cottons are crossed with certain wild species, it has been found that the hybrids possess outstanding strength. For the past several years, attempts have been made to bring this strength into Upland cottons. The wild species used in this work was *Gossypium Thurberi,* a lintless type from Arizona.

Strengths up to 75 per cent higher than the recurrent Upland parent have been selected and maintained through repeated backcrosses. The inheritance of this outstanding strength is not too complex. After the first two backcrosses, it is possible to maintain the same high level of strength through repeated backcrosses by selection. However, when outstanding strength is selected from a segregating population, the chosen plants also possess small bolls, small seeds, low lint percentage and fibers with narrow perimeters. For this reason, it has not been possible to obtain both high yields and outstanding strength. It has been assumed that certain characteristics have been carried over from the wild species which not only carry factors for strength but also account for the depressed yield.

FIG 15. A GOOD GROWTH OF COVER CROPS INCREASES COTTON YIELDS.
(UPPER COASTAL PLAIN STATION-1946)



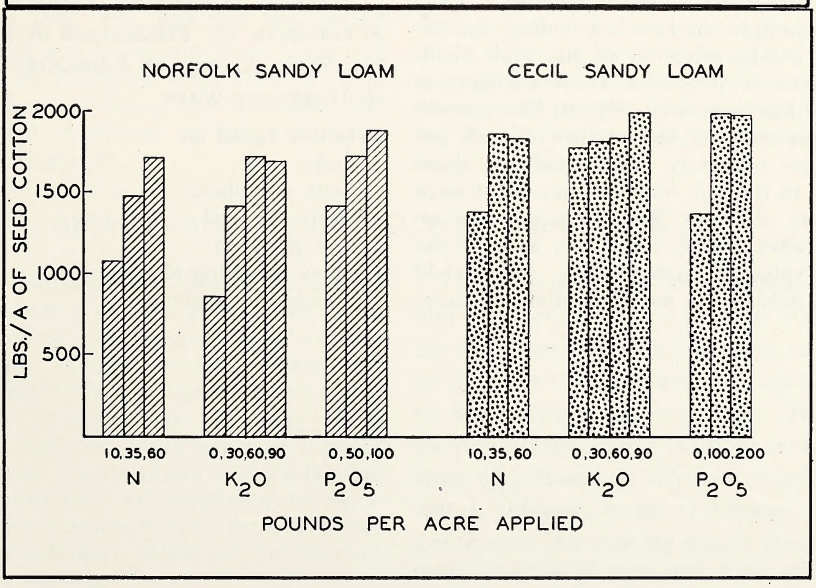


FIG. 16. COTTON REQUIRES HIGH AMOUNTS OF NITROGEN (N), POTASH (K_2O) AND PHOSPHORUS (P_2O_5) TO PRODUCE HIGH YIELDS (TWO-YEAR AVERAGE).

DEVELOP A NEW PLANT BREEDING METHOD

The usual plant breeding technique used to increase yields is to obtain hybrid material and select within the progeny of this material for higher yielding types. The character measured is the actual yield itself. While this seems to be an obvious and direct approach, it is not necessarily the most effective.

The yield of individual plants in a row is greatly affected by minor variations in soil fertility, soil moisture, shading and competition from neighboring plants and other environmental influences. These environmental factors may become so great, even in relatively uniform nurseries, as to mask genetic (inherited) differences almost completely. Similar difficulties arise in making selections between progeny rows from selected plants. However, the characteristics that make up yield are not as sensitive to these environmental influences, and selection for them can be more effective.

For example, in breeding cotton for increased yields, selection of the high yielding plants or progenies from segregating material has been very difficult. The amount of lint per seed and the number of seeds per boll were relatively unaffected by small changes in the soil, but bolls per plant were extremely sensitive. Therefore, using a selection index, which takes into account the genetic value of each of these three yield factors, actually is more effective in choosing superior yielding strains of cotton than the simple use of yield itself.

Such an index was used on four families of Sea Island Cotton. The effectiveness of the technique ranged from 6 to 58 per cent better than selection for yield itself.

It is interesting to note in Table 1, that none of the individual characters used is as effective in selection as yield. For example, seeds per boll was only 29 per cent as useful when it was the only character on which selection was based. However, when the three are combined by properly weighting each, an average increase of 16 per cent over straight yield was obtained. This means that using such a scheme for making plant selections gave a group of selections that were genetically 16 per cent better than would have been obtained by selection for yield alone.

TABLE 1. ESTIMATED AVERAGE GENETIC SUPERIORITY (IN PERCENTAGE OF SELECTION FOR YIELD ALONE) OF PROGENIES SELECTED IN DIFFERENT WAYS.

Selection based on	
Yield	100
Bolls per plant	91
Seeds per boll	29
Lint per seed	74
Index involving above three yield components	116

PASTURES AND FORAGE

LADINO CLOVER OUT-GROWS THE GRASS

It is frequently quite a problem to prevent white clover from being crowded out by the grasses in the soil. Ladino clover, on the other hand, may grow so rapidly as to make it difficult to maintain a grass with it. Seedings made on a Cecil sandy loam in the fall of 1944 yielded as follows in 1946:

Ladino with orchard grass—4,165 lbs. dry matter per acre.

Ladino with Dallis grass—4,013 lbs. dry matter per acre.

Ladino with brome grass—4,028 lbs. dry matter per acre.

Ladino with Coastal Bermuda—4,007 lbs. dry matter per acre.

The yields are approximately the same because most of the grasses had been eliminated and in the main, only the Ladino clover was left. There was more orchard grass than any of the others, but it had been greatly reduced.

LADINO IS WIDELY ADAPTED

A mixture of Ladino clover and orchard grass was seeded on a severely eroded paddock on the Animal Husbandry unit of the North Carolina Agricultural Experiment Station in 1945. The area was not grazed during 1946 but it was cut three times for hay with an estimated total yield of three tons of hay per acre. By November the growth had recovered to the extent as shown in **Figure 17.**

Ladino clover is now being successfully grown in all sections of the state. Demonstrations by farmers have shown that it now has a much wider range of adaptation than originally thought. There are no accurate data on the acreage in North Carolina but the increase was large during 1946. A typical county on the Virginia state line seeded 1800 pounds; while a county bordering South Carolina was estimated to have exceeded that figure.

ALFALFA AND LADINO CLOVER NEED FERTILIZER

Farmers recognize that alfalfa and Ladino clover not only produce higher forage yields than lespedeza but forage with a greater protein and mineral content. These two factors, high yield and high nutritive value, combine to produce heavy per acre yields of animal food and heavy per acre removal of plant food. This is shown in the following figures taken from an experiment in which all crops were grown with uniform fertilizer and lime treatments. Yields are for the first year after seeding.

	Lbs. Protein per Acre	Lbs. P_2O per Acre	Lbs. K_2O per Acre	Lbs. CaO per Acre
Alfalfa	937	28.9	99.5	77.8
Ladino	884	28.4	117.2	67.0
Lespedeza	388	11.9	32.1	24.1

These figures show the opportunities for high production offered by these plants. At the same time, they should serve to remind us that this high production is accompanied by high removal of plant foods. These are plants with the ability to utilize large quantities of nutrients in efficient production. It will be necessary to see that these nutrients are present and that the supply does not become depleted if continued high production is to be maintained. As can be seen, both Ladino and alfalfa are heavy potash feeders and will require relatively large amounts of this element to maintain satisfactory stands and growth.

ALFALFA NEEDS PHOSPHATE

The need for adequate phosphorus on alfalfa is shown in the following yields on a Piedmont soil:

Treatment	Increase over No Phosphorus 1945-46 Average
50 lbs. phosphoric acid at planting	654 lbs. per acre
100 lbs. phosphoric acid at planting	1496 lbs. per acre

In this case, 100 pounds phosphoric acid per acre was twice as effective in increasing yields as was 50 pounds, indicating that on some soils even higher rates might be applied economically to alfalfa. It is believed that on most North Carolina soils at least 100 pounds phosphoric acid per acre (equivalent to the phosphorus in 833 pounds 2-12-12) should be applied and worked into the soil at planting, with extra phosphorus added on soils that are very low in this element. A good supply of phosphorus plays an important part in growing this crop satisfactorily, and there is little danger of applying too much.

TALL FESCUE, A PROMISING GRASS

Tall fescue is a tall growing bunch grass having the same type of growth as orchard grass and a wider blade than commercial meadow fescue. It is also very green in color, being darker than most of our perennial grasses, remaining greener in midsummer and midwinter than orchard grass and seemingly adapted to a wider range of soil conditions than is orchard. Like most other crops it is not perfect; its main weakness being that it is not as palatable as some of our other grasses, although livestock do eat it readily.

Preliminary information suggests that maybe here is a grass that will grow under a wider range of conditions than orchard, and particularly on the more moist soils. This would fill a real need for a more productive grass for the poorly drained soils where redtop has been used and for an early grass to grow with Ladino clover in the east.

The two varieties of tall fescue that are available in a limited way are Kentucky 31 and Alta. The Kentucky 31 was developed by the Kentucky Experiment Station from a selection from the farm of a Mr. Suiter in Kentucky. It is often referred to as Suiter grass. Alta fescue was developed by the Oregon Experiment Station. W. H. Rankin of the North Carolina Experiment Station found an imposing looking grass on the roadside in Buncombe County a few years ago that was identified as a tall fescue. It is now referred to as a North Carolina strain.

During 1945 the following yields were obtained from tall fescue in experiments at Raleigh:

Alta fescue—2,555 pounds dry matter per acre.

Kentucky 31 (Suiter)—2,492 pounds dry matter per acre.

N. C. strain—3,167 pounds dry matter per acre.

Orchard grass—1,829 pounds dry matter per acre.

Only one cutting was made during the summer of 1945 but during the following summer, five harvests were made. These were as follows:

Alta fescue—5,161 pounds dry matter per acre.

Kentucky 31 (Suiter)—5,322 pounds dry matter per acre.

The North Carolina strain was moved to another location for seed increase before the last cutting of 1946 but during the first four cuttings produced as much as either of the other two strains. Alta, Kentucky 31 and the N. C. strain are equal in yielding ability and were superior to orchard at the location tested.

The tall fescue is not to be confused with meadow fescue. The latter is the variety that is available from most seedsmen but it has not proved to be superior in tests at the North Carolina Agricultural Experiment Station. In fact, it is decidedly inferior to tall fescue or to other adapted grasses like orchard.

BIG TREFOIL, A NEW LEGUME FOR THE LOWLANDS

Experimental plantings made at the Tidewater Experiment Station in September, 1945, included among other legumes, a smooth and a hairy strain of big trefoil (Lotus uliginosus). Apparently it was ideally suited to the low, moist soil at the Tidewater Station, producing more growth than any of the other legumes in the trial, in-

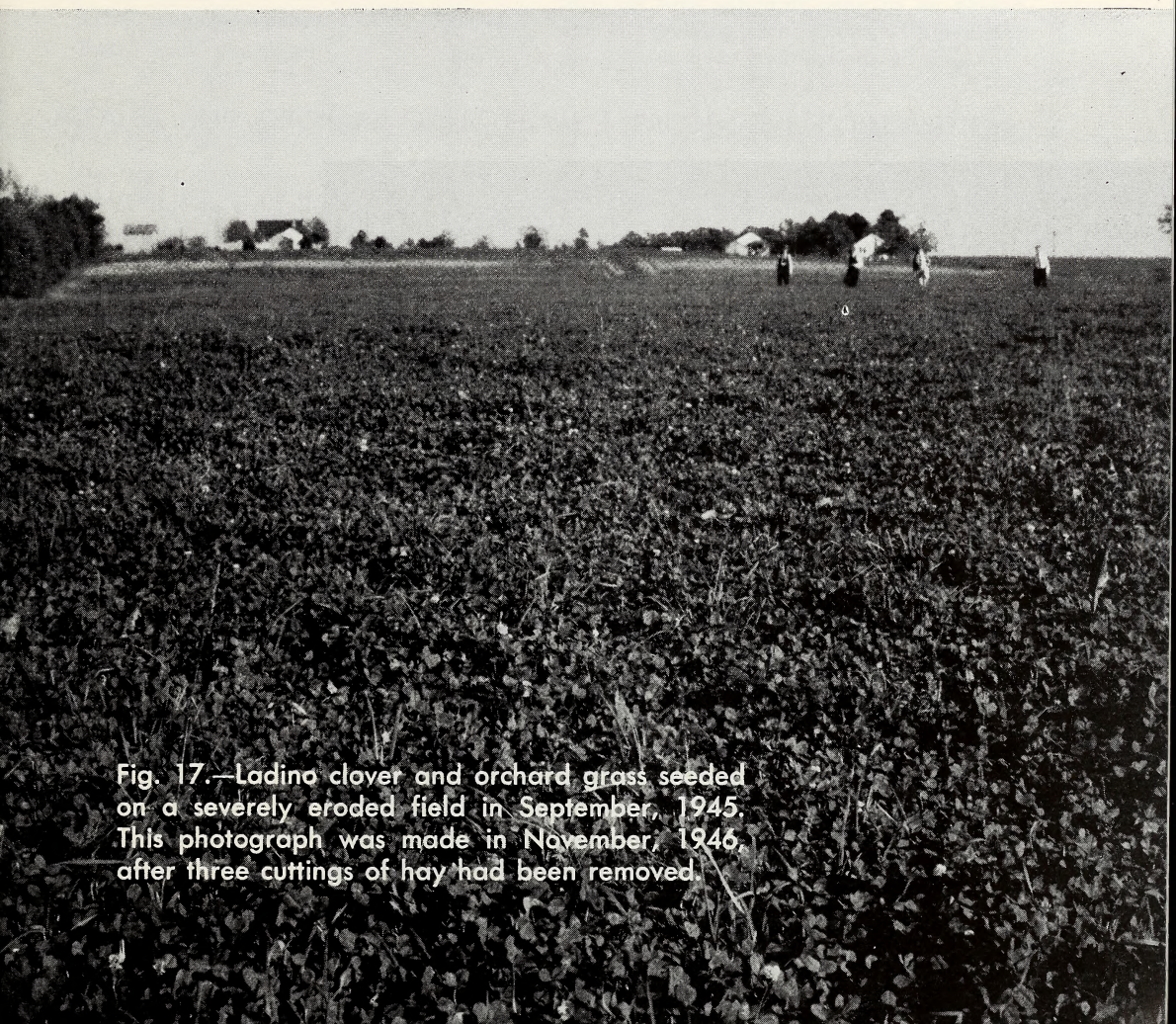


Fig. 17.—Ladino clover and orchard grass seeded on a severely eroded field in September, 1945. This photograph was made in November, 1946, after three cuttings of hay had been removed.

cluding the rapid growing Ladino clover. By midsummer of 1946 the plants from the three and one-half foot rows had completely covered the land. By the end of the growing season they had produced a thick mat of growth resembling a heavy crop of alfalfa that had lodged. All weed growth was completely smothered.

Big trefoil was also seeded several years ago in a carpet grass sod at the Coastal Plain Station near Willard. In addition, several other legumes were seeded at that time, but by the summer of 1946 this trefoil was the only surviving legume.

Studies are being enlarged in an attempt to get a better evaluation of this perennial legume, but preliminary evidence indicates that it may be the partial answer to the problem of maintaining a legume on poorly drained soils of Eastern North Carolina where carpet grass is the primary constituent of the sod. **(Fig. 18).**

FIG. 18. BIG TREFOIL GROWING AT THE TIDEWATER EXPERIMENT STATION, PLYMOUTH, NORTH CAROLINA. PHOTOGRAPH WAS TAKEN IN OCTOBER, 1946, FROM PLANTINGS MADE IN SEPTEMBER, 1945.

APPLY PHOSPHORUS FOR ALFALFA AT PLANTING

The advisability of applying several years supply of phosphorus at time of planting alfalfa, has been demonstrated in an experiment in Haywood County. Eighty pounds of P_2O_5 (phosphoric acid) applied at planting increased yields in the following manner:

	Increase in Yields
First Year	857 pounds per acre
Second Year	961 pounds per acre
Third Year	1,365 pounds per acre

Thus, the effectiveness of this material increased rather than decreased with time and one would be safe in providing a good supply to start with. Such a practice would save labor as well as allow the fertilizer to be mixed into the soil before seeding. On the basis of the above figures, it seems likely that enough phosphorus might well be applied at seeding to last the life of the stand.

FUSED ROCK PHOSPHATE, A GOOD SOURCE FOR FORAGE PLANTS

Three years results with fused rock phosphate on alfalfa in Haywood County show it to be a satisfactory source of phosphorus for this crop. Yields were as follows:

No phosphorus	4,735
Triple superphosphate	5,664
Fused rock phosphate	5,900

Previous work with permanent pasture and lespedeza, coupled with the above figures, indicate that this material is as good or better than the more soluble sources of phosphorus in growing forage plants. In fact, its slow solubility may be an advantage in supplying these plants with available phosphorus over long periods of time.

ALFALFA AND ORCHARD GRASS FORM A PRODUCTIVE COMBINATION

One way to grow more feed on less land is illustrated in the following figures from a rather poor Piedmont soil:

	Av. Yield 1945-46
Dallis grass—	
Lespedeza	4,021 pounds per acre
Alfalfa—	
Orchard grass	6,449 pounds per acre

Both sods received the same lime and fertilizer treatments and were grown on "lespedeza" land. In addition to the increased yield, the alfalfa-orchard grass combination was higher in protein, phosphorus and calcium, making it a more nutritious forage. Livestock growers who wish to feed more animals on the same land are accomplishing their purpose, in many cases, by using more productive plants such as alfalfa. The fact should not be overlooked, however, that Dallis grass-lespedeza, properly fertilized, is still a good pasture. North Carolina could use more of that combination also.

ORCHARD GRASS GIVES QUICK RESULTS

With the present price of grass seed one may have a little curiosity about what part of the mixture will actually produce grazing. In several experiments conducted in the Mountains and Piedmont, five pounds per acre each of the three grasses, orchard grass, redtop, and Kentucky bluegrass, plus legumes, were seeded as a mixture. The development of the grass in the sod from the second to the sixth year after seeding may be seen in **Figure 19.**

This graph shows that redtop played a very small part in producing forage and soon passed out of the picture. Bluegrass

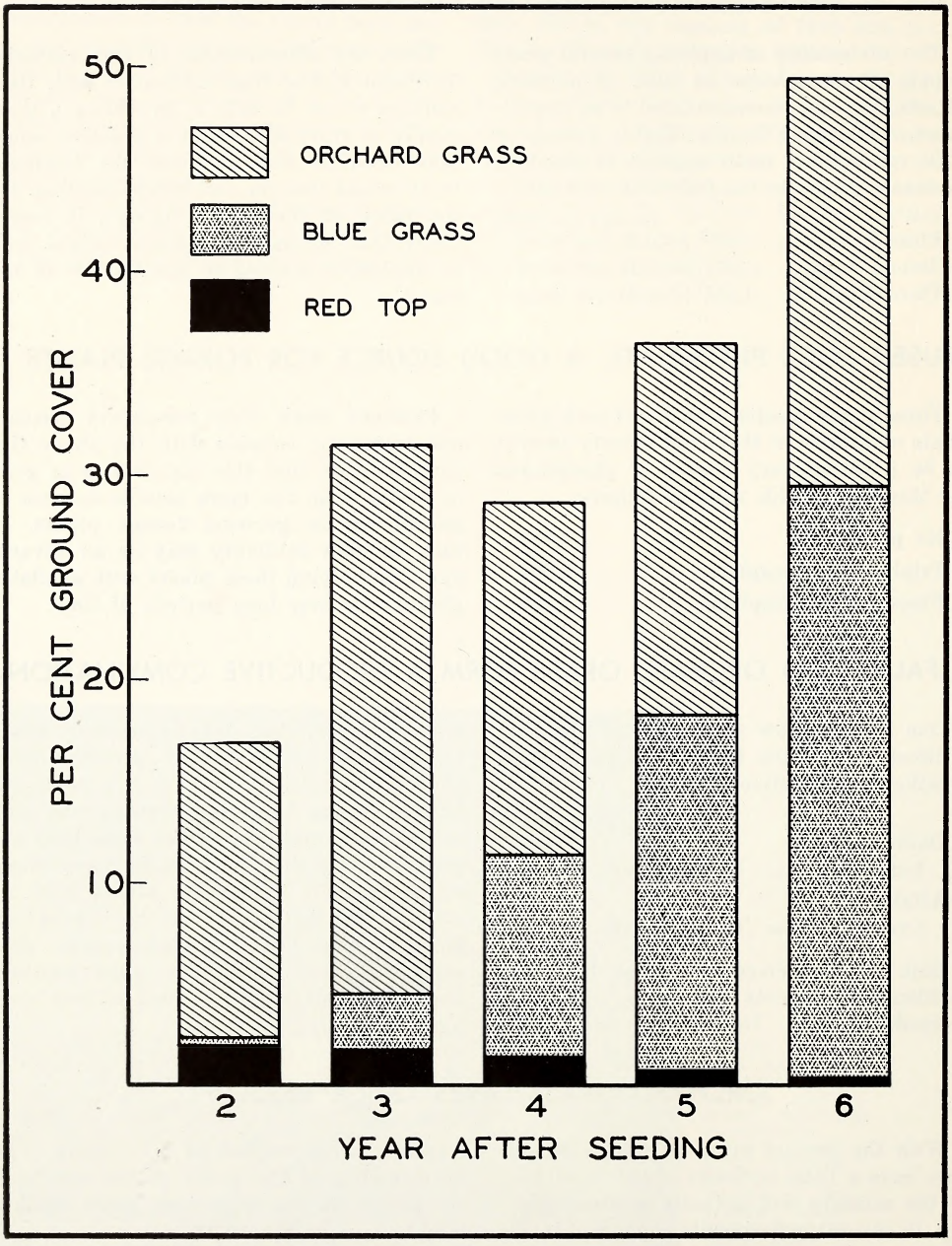


FIG. 19. DEVELOPMENT OF GRASSES IN GRASS-LEGUME SOD.

contributed very little until after the fourth year, while orchard grass carried the load in the early years and continued to supply a substantial part of the grazing throughout the experiment. Since orchard grass seems to be the one most likely to earn its salt it seems logical that it should be the one seeded. Perhaps the rest of the grass seed money would be better invested in fertilizer and legume seeds. In fact, bluegrass volunteers in most pastures in this area *as soon as the fertility becomes high enough.* So if you want bluegrass, buy fertilizer instead of bluegrass seed.

The quick establishment feature of orchard grass as shown here is one reason why it is an excellent grass to seed with a vigorous growing legume like Ladino clover.

ANOTHER PROTEIN CONCENTRATE FOR LIVESTOCK

A pasture mixture, consisting largely of white clover and orchard grass, averaged 22.2 per cent protein over a period of two years, growing on a Cecil sandy loam in Wake County.

White clover growing in this mixture was highest in protein content but the orchard grass growing with this vigorous clover sod was unusually high in this constituent, as shown by the following:

White clover.....25.7% protein
Orchard grass.....23.9% protein

Of course, such nutritious forage cannot be produced without proper fertilization and management practices. Adequate quantities of limestone, phosphate and potash were applied. This looks like an economical replacement for high priced protein supplements in feeding dairy cows.

STUDY DALLIS GRASS

Although seed can be obtained from both domestic and foreign (Australian) sources, there is only one commercial variety of Dallis grass. This strain, called "common," breeds true to type regardless of seed course. In recent years, three additional strains of Dallis grass have been discovered which are different from common Dallis and inferior to it as forage plants. The new strains are useful, however, since they offer an opportunity to investigate the breeding behavior of Dallis.

The three new strains include: (1) a leafy type from Tifton, Georgia, which produces more forage growth than common Dallis but is a very poor seed producer, (2) a yellow-anthered, upright type from Uruguay which is a good seed producer, but makes a stemmy, unproductive vegetative growth, (3) a leafy stoloniferous (creeping) type from Uruguay which spreads rapidly but does not produce well. Each type appears to breed true from seed.

A comparative study of these strains and common has yielded additional evidence regarding the breeding behavior of Dallis grass. In seed germination tests it is found that the common and the Tifton, Georgia, seed produce 1 to 3 per cent twin seedlings. When the twins are separated and grown to maturity, it appears that they are identical with each other in every significant characteristic and that the normal seedlings are also identical with each other and with the twin plants. If normal pollination and fertilization occurred in the formation of Dallis seed, one would expect to observe marked differences between the seedlings.

A controlled pollination experiment was conducted to determine the character of seed development in Dallis. The flowers of certain seed heads were emasculated and bagged to prevent pollination, while other heads on the same or closely related plants were permitted to open-pollinate normally. In addition, other heads were emasculated and then pollinated by hand. As expected, the yellow-anthered strain set considerably

more seed than the other types. The most striking result of this experiment, however, is the fact that the flowers in which pollination was entirely excluded by emasculation and bagging produced nearly as much seed as the flowers which were hand pollinated or those which were permitted to open-pollinate.

The evidence obtained in the past year confirms the conclusion that nearly all the seed produced by Dallis grass is asexual in origin. This means that conventional breeding procedures will not succeed when applied to the problem of developing improved varieties in this species. Fortunately, other methods exist for obtaining variability in such cases and these can be adapted to Dallis.

PEANUTS

CONTINUOUS PEANUTS REQUIRE POTASH AND PHOSPHATE

Experiments in the past have shown that if peanuts are grown in a well fertilized rotation, little response to direct applications of either potash or phosphate can be expected. For various reasons, however, many farmers are forced to plant peanuts following peanuts. Although this practice is certainly not recommended by the Experiment Station, it presents a problem in peanut fertilization.

In 1945, tests were set up to determine if fertilizer is required when peanuts follow peanuts. Three of these tests were continued in 1946. This was the third straight year of continuous peanuts on one of the tests and the second year on the other two. The usual practice of removing all vines was followed and no winter crop was used. Therefore, large amounts of phosphate and potash were removed by this system of croping. Average yield data for potash and phosphate plots, given in **Figure 20,** show that both potash and phosphate increased the yield of nuts. Potash was more effective when lime was also applied. This is in agreement with previous experiments in which it was found that the response to potash was greater when the calcium requirements of the plants had been met.

The addition of potash and phosphate in the three experiments had no appreciable effect on the shelling percentage. However, plants from these plots were generally larger than plants from check plots. The yield increases obtained, therefore, were due to an increase in plant size rather than increased filling. This is shown in the size of stacks from representative plots of fertilized and unfertilized plots **(Fig. 21).**

FERTILIZING ROTATION IMPORTANT IN PEANUT PRODUCTION

Three cotton-peanut rotation experiments begun in 1945, were continued in 1946. Direct applications of potash to peanuts gave no higher peanut yields than when the same amount of potash had been added to the cotton the previous year. The results from these and other experiments show the advantage of heavily fertilizing the rotation in which peanuts are grown, rather than applying fertilizer directly to the peanuts.

Two of the three tests were located on soils rather low in calcium. Yields and shelling percentages were increased by additions of lime or landplaster. On the third experiment, where the calcium level was high, neither lime nor landplaster increased yields.

DISTRIBUTE CALCIUM UNIFORMLY TO PEANUT PLANT

The supply of calcium is important in peanut production. It must be present in the "pegging" area or poor quality fruit (pops) often result. Controlled experiments were set up in 1944 and 1946 to determine if supplying calcium to one side of a peanut plant would affect the filling of fruits on the other side. The rooting zone (soil) was separate from the pegging zone in such a way that plant foods could be supplied to the pegging zone only.

A typical plant from the 1946 experiment is shown in **Figure 22.** The fruits on the side to which calcium was supplied are healthy and most of them are filled. The other side of the same plant produced very

few fruits and most of them were pops.

These experiments indicate that calcium supplied to one side of the plant will not adequately take care of the calcium requirements of the fruit on the other side of the plant. Therefore, in supplying calcium to the pegging zone it must be uniformly distributed to get a maximum of filled fruits.

MANY POTENTIAL PEANUTS LOST EARLY IN DEVELOPMENT

An analysis of the efficiency of peanut plants as pod and seed producers shows that unexpectedly large losses in potential peanut production occur in the early stages of peg development. As the Experiment Station continued its investigation of "pops" and other forms of seed failure in the large type peanut varieties favored by North Carolina growers, attention was also given to the origin of the undesirable one-seeded pods common in these varieties.

All pods of a large seeded Jumbo runner variety of peanut have the potentiality for containing two, occasionally three, seeds. The ovules (embryonic seeds) are visible microscopically even in the peanut flower. As the pegs develop, the ovules are carried into the soil.

Fifty peanut flowers appearing in June or July will contain 100 ovules, most of which are pollinated normally and begin to develop into seeds. Because of competition between the many flowers on a single plant, however, only two-thirds of the flowers produce pegs. Therefore, a third of the possible seed yield is lost early in the sea-

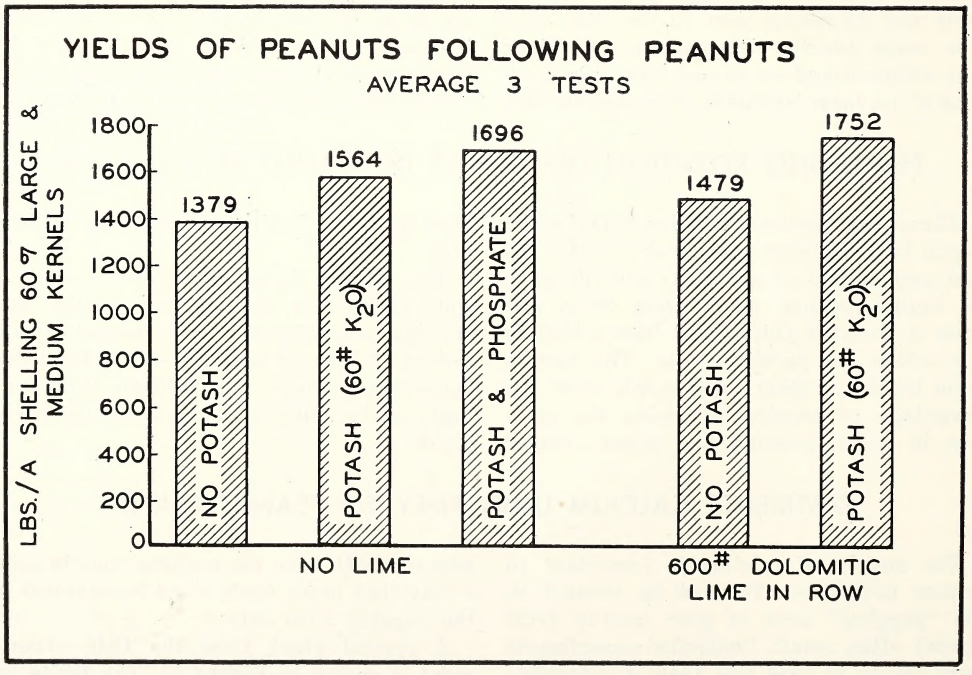


FIG. 20. IF PEANUTS ARE GROWN FOLLOWING PEANUTS RATHER THAN IN A HEAVILY FERTILIZED ROTATION, APPLICATIONS OF POTASH AND PHOSPHATE MAY INCREASE YIELDS. LANDPLASTER WAS APPLIED (600 LBS./A) ON ALL PLOTS. (POTASH PLUS PHOSPHATE EQUALS 500 LBS. 0-12-12).

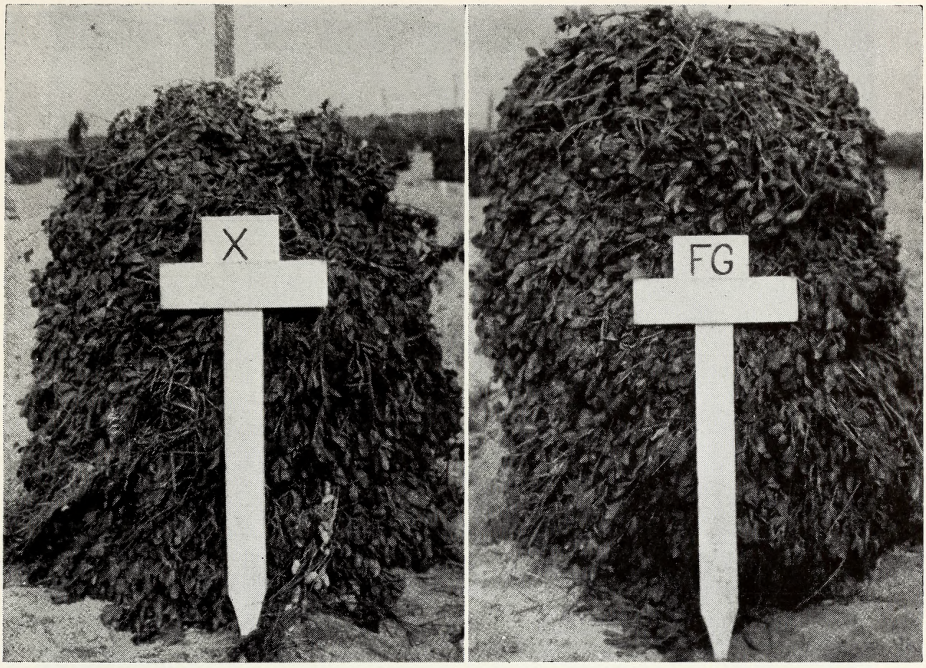


FIG. 21. WHEN PEANUTS FOLLOW PEANUTS, FERTILIZER APPLICATIONS MAY BE PROFITABLE. THE INCREASES ARE USUALLY DUE TO INCREASE IN SIZE OF PLANTS. LEFT (X): PEANUT STACK FROM PLOT RECEIVING NO TREATMENT. RIGHT (FG): STACK FROM PLOT RECEIVING 500 LBS. 0-12-12.

son. Next, the pegs grow downward and penetrate the soil to a depth of one or two inches. In this phase of the process, two-thirds of the pegs fail to make the grade. Twenty-one of the original ovules reach this stage, but even as the pods mature underground some of the seeds fail to develop. At harvest time the mature peanuts picked on a given plant represent about one-tenth of the potential seed production. When adequate calcium is not available an even lower proportion of the seeds reach maturity.

A familiar aspect of peanut seed failure is the occurrence of numbers of one-seeded pods. Each one-seeded pod represents a 50 per cent loss in seed production. **Figure 23** illustrates normal two- and three-seeded pods and various types of one-seeded pods. Often 15 to 20 per cent of the peanuts are one-seeded.

Microscopic examination of embryonic peanut seeds during the first two weeks of peg growth shows that 7 per cent of the ovules fail to be pollinated. When this happens it is usual for one of the two ovules to be properly pollinated while the other is not. When such a peg matures it bears a pod like those at the bottom of **Figure 23.** In the first two weeks the peanut peg grows very rapidly, for this is the period in which it approaches and penetrates the soil. About 10 per cent of the ovules abort during this period. In such cases one ovule in the peg tip will abort while the other usually continues normal development. These pegs also produce one-seeded pods. Thus, a total of 17 per cent of the developing pegs are destined to produce only a single seed, either because of pollination failure, or because of early abortion.

The embryo is the portion of the seed which eventually develops into a new plant,

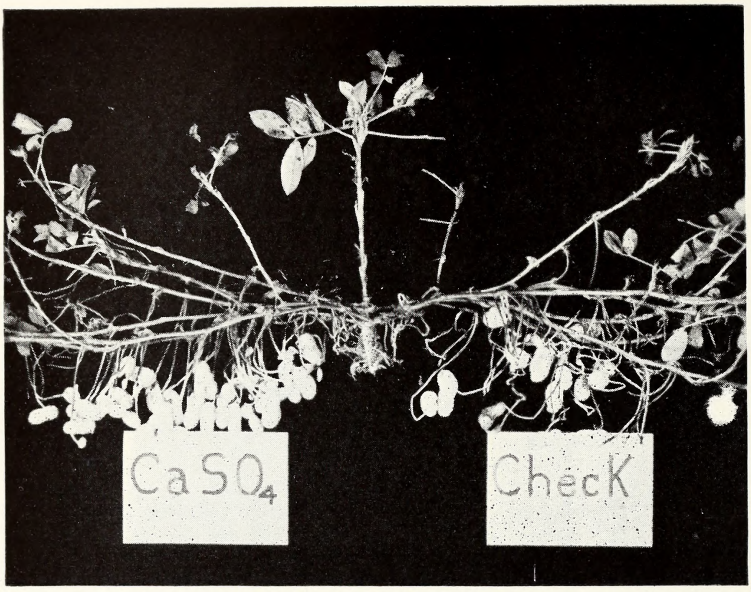


FIG. 22. CALCIUM APPLIED TO THE PEGGING ZONE ON ONE SIDE OF A PEANUT PLANT WILL NOT BENEFIT THE FRUIT ON THE OTHER SIDE. PEANUTS ON THE LEFT SIDE RECEIVED A CONTINUOUS SUPPLY OF CALCIUM ($CASO_4$); THOSE ON THE RIGHT RECEIVED NO CALCIUM (CHECK).

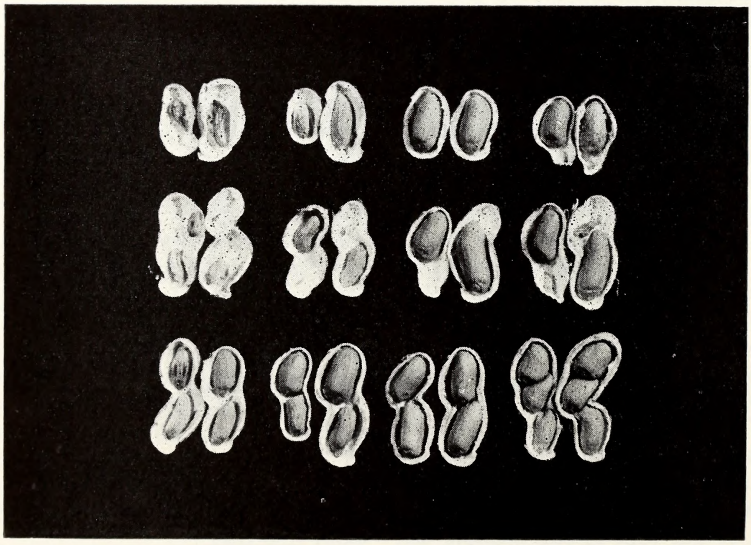


FIG. 23. SEEDS AND PODS OF A JUMBO RUNNER PEANUT ILLUSTRATING TYPES OF SEED FAILURE.

FIG. 24. ARACHIS GLABRATA. A VIGOROUS POLYPLOID RUNNER PEANUT WHICH SHOWS CONSIDERABLE FREEDOM FROM THE ATTACK OF THE COMMON LEAF SPOT DISEASES OF PEANUTS.

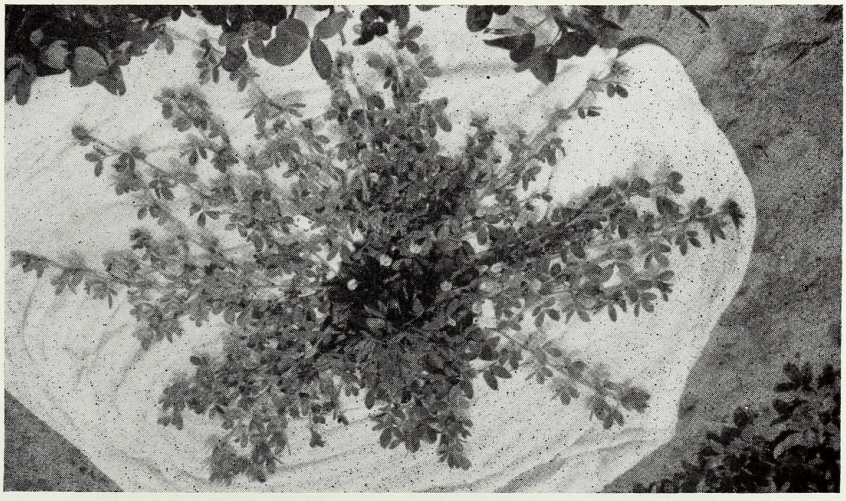


FIG. 25. ARACHIS SP. DIPLOID PERENNIAL RUNNER PEANUT WITH HEAVY TUBEROUS ROOT STOCKS WITH ADVENTITIOUS ROOT SYSTEMS DEVELOPED ON THE PEGS. CULTIVATED PEANUTS IN THE FOREGROUND.

while the endosperm is the portion in which food materials are stored during the early stages of growth. In both the embryo and endosperm, growth stops at the fifth day and is resumed after the tenth day. This is the very period in which the pegs begins its rapid elongation. It looks as if the growth of the peg is in direct competition with the development of the seeds it contains. This may be the reason for the loss of 10 per cent of the seeds by early embryo abortion.

PEANUT BREEDING PROGRAM UNDERWAY

One thousand two hundred and fifty individual grandchildren from crosses between the 10 most different varieties of commercially produced peanuts in the United States were tested in 1946.

This testing program is designed to evaluate the breeding capacity of the different commercial types now grown in the coun-

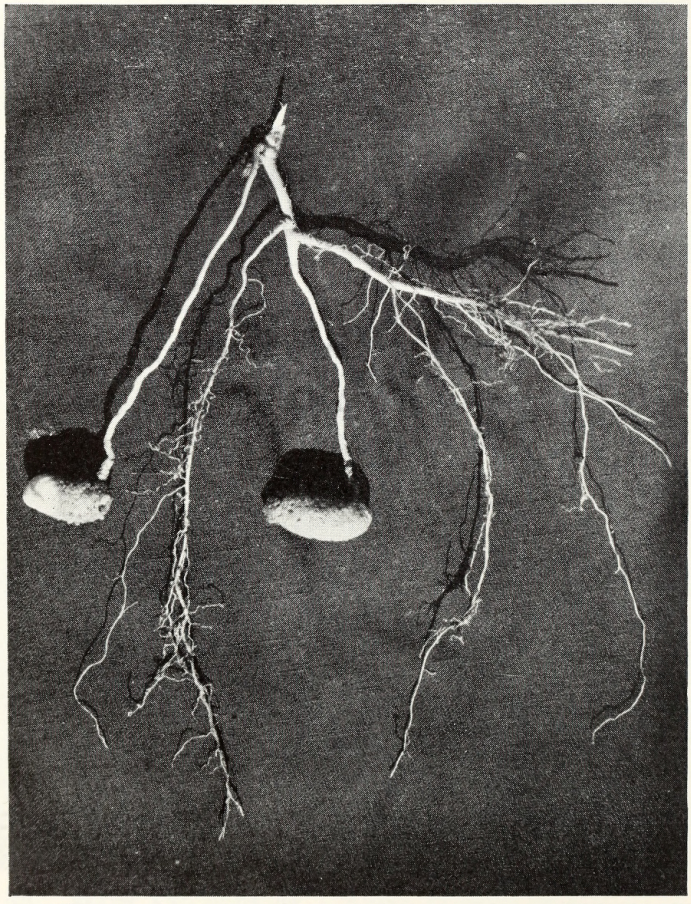


FIG. 26. PEGS AND FRUITS FROM THE PLANT SHOWN IN FIGURE 25. NOTICE THE WELL DEVELOPED FIBROUS ROOT SYSTEM ON THE PEG TO THE RIGHT.

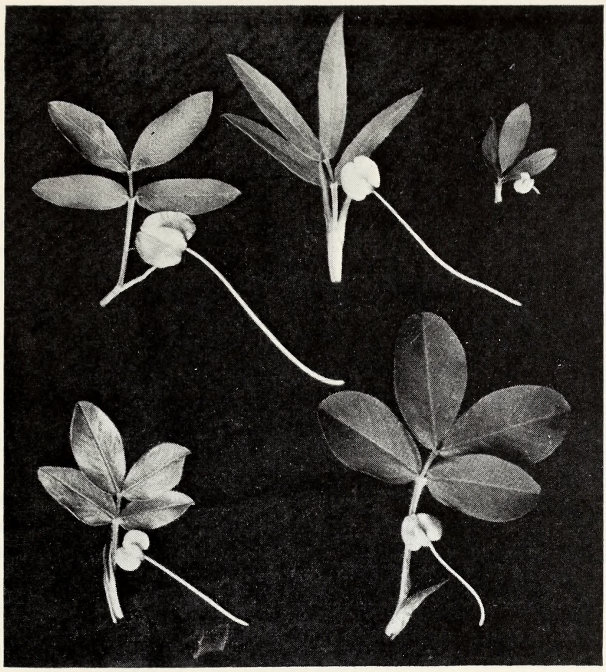


FIG. 27. LEAVES AND FLOWERS OF FOUR SPECIES OF PEANUTS AND A WILD RELATED LEGUME NATIVE TO NORTH CAROLINA. TOP ROW: FROM LEFT TO RIGHT, ARACHIS GLABRATA, ARACHIS DIOGOI, STYLOSANTHES SP. BOTTOM ROW: FROM LEFT TO RIGHT, ARACHIS SP. AND ARACHIS HYPOGAEA (CULTIVATED PEANUT).

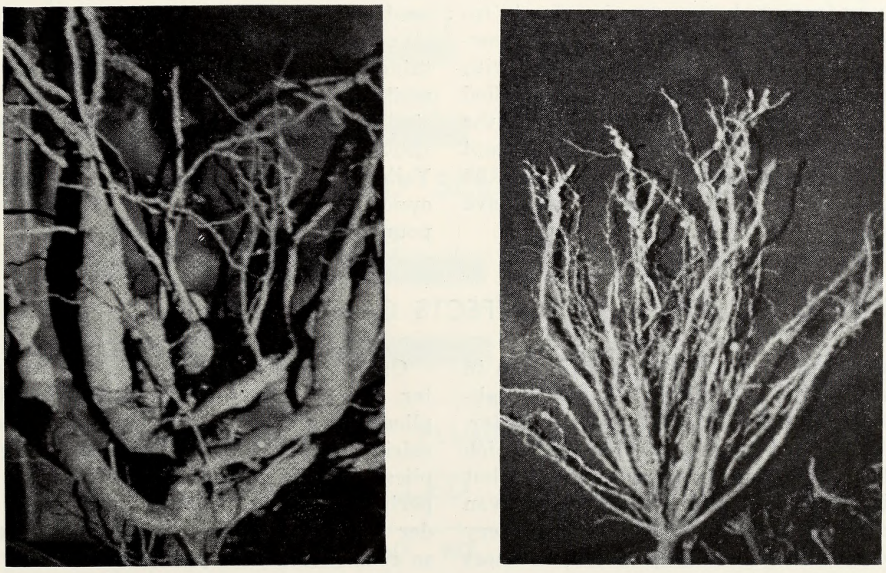


FIG. 28. ROOT SYSTEMS OF N. C. BUNCH (RIGHT) AND A WILD PERENNIAL PEANUT FROM SOUTH AMERICA (LEFT).

try. Meanwhile, efforts to introduce more widely different peanut germ plasm into North Carolina are continuing.

Hundreds of peanuts have been introduced to North Carolina from many foreign lands, but only those from the peanut's native home in South America give promise of sufficient heritable variation to be of value in the breeding program. (Some of the wild forms now growing at the Experiment Station are shown in **Figs. 24-28.**)

No crossed seed of these wild species with commercial varieties has been produced. However, each one has been successfully cross pollinated with the cultivated varieties. When such crosses are made, a normal peg develops and a normal pod forms underground, but inside this pod the species-hybrid embryo remains small and underdeveloped **(Fig. 29)**. Work is now underway to devise means of turning these little embryos into the successful incubator babies of the peanut world.

PEANUT STANDS ARE INFLUENCED BY SEED QUALITY

In studies on the influence of various peanut seed qualities on stand, both treated and untreated samples of machine-shelled and hand-shelled seed from the same source were compared in field tests at the Upper Coastal Plains Branch Station.

Figure 30 shows the average stands obtained with severely, moderately, and slightly shrivelled and plump seeds selected from hand-shelled and machine-shelled lots of N. C. #4 Virginia Bunch peanuts. As the seed size increased, the average stands increased from 12 to 63 per cent. The benefits of seed treatment were greater with machine-shelled lots than with hand-shelled lots. The treatment used in obtaining the data presented in **Figure 30** was 2 per cent Ceresan at the rate of four ounces per 100 pounds of seed. Other materials used gave similar results.

The seeds used in obtaining the data for **Figure 30** were free from discoloration or obvious injury to the seed coat. In **Figure 31** are shown data obtained when plump seeds from hand- and machine-shelled lots selected on the basis of injury, were planted. It may be noted that seed treatment gave only slight increases in stand if either unblemished or discolored hand-shelled plump seeds were used. When machine-shelled unblemished, discolored or injured seed were treated, marked improvement in stands resulted. These data were also obtained using 2 per cent Ceresan as described above. Other materials, which gave similar results, were used at the following rates: Phygon, 2 ounces; Dow 9B, 2 ounces; Yellow Cuprocide, 4 ounces; Arasan, 3 ounces; and Spergon, 4 ounces per 100 pounds of seed.

ORGANIC MATTER IN SOIL AFFECTS CALCIUM NEEDS OF PEANUTS

When peanuts are grown in soils high in organic matter, the calcium needs are higher than with soils of lower organic matter. This is true not only in heavier soils which are dark and high in organic matter but also in the very sandy soils, because even though the organic matter is low in very sandy soils it still is responsible for most of the calcium-retaining properties of the soil.

On these dark soils high in organic matter, it is necessary to use either liberal applications of landplaster, or to keep up the calcium level with relatively high lime applications. This was demonstrated in experiments where peanuts were grown under controlled conditions in outdoor frames so constructed that peanut roots were separated from the area in which the peanut fruit formed. A dark soil high in organic

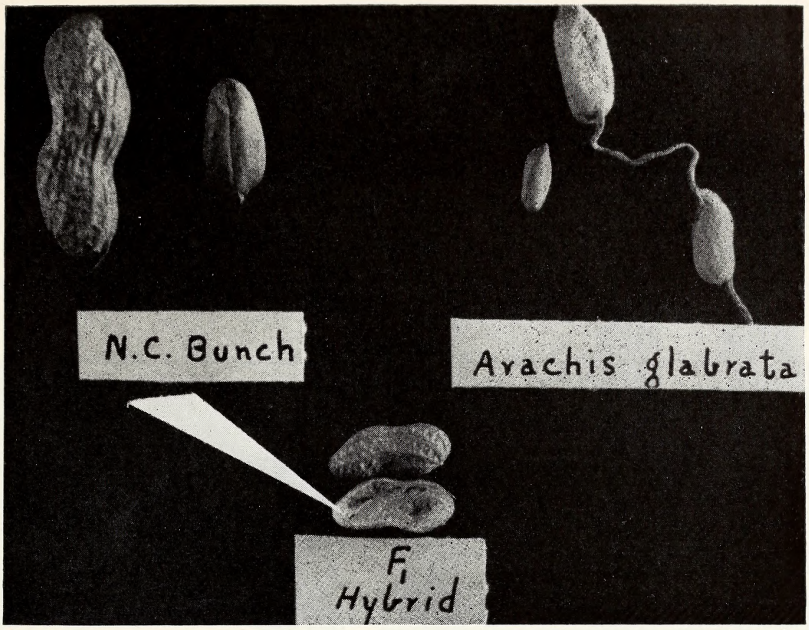


FIG. 29. THE ARROW INDICATES THE UNDEVELOPED SEED IN THE HYBRID WHICH IS A CROSS BETWEEN N. C. BUNCH AND A SOUTH AMERICAN WILD PEANUT (A. GLABRATA).

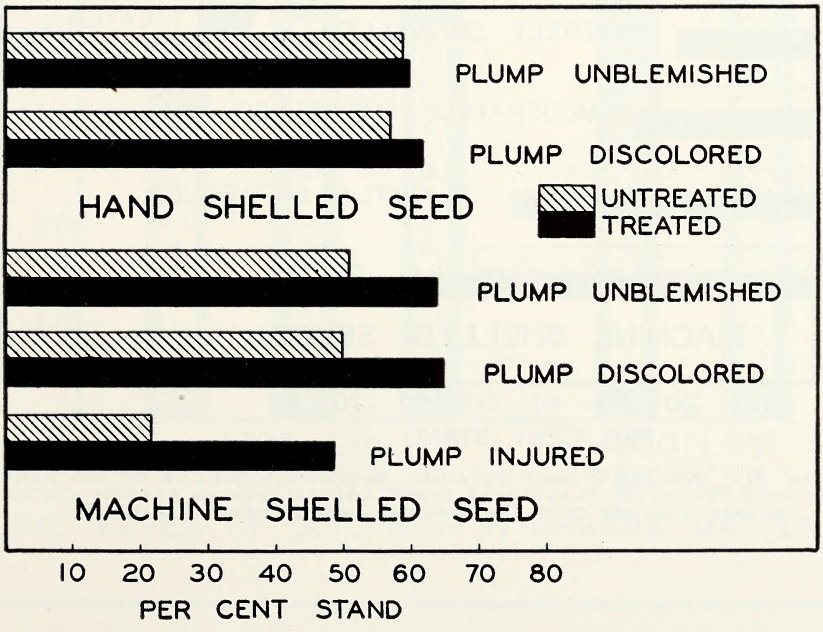


FIG. 30. AVERAGE STANDS OBTAINED IN SIX REPLICATIONS OF 100 HAND-SHELLED BLEMISH-FREE SEEDS PLANTED AT UPPER COASTAL PLAINS BRANCH STATION IN 1946. TWO PER CENT CERESAN USED IN SEED TREATMENT. THE VARIETY USED WITH N. C. 4 VIRGINIA BUNCH.

matter was used for the area in which the fruit was produced. Calcium was supplied to this area by two means: by adding the equivalent of two tons of ground limestone and by adding various rates of landplaster. Additional landplaster was applied to some of the limed plots to determine whether it would be beneficial under such conditions. The results are illustrated in **Figure 32** where it may be seen that on soils high in organic matter the calcium needs can be met by either applying a sufficient amount of lime or by liberal applications of landplaster.

To the farmer growing peanuts this means that he must take into account not only the calcium level of his soil, but also the *type* of soil. Peanuts require higher calcium levels on some soils than on others, if high quality nuts are to be produced.

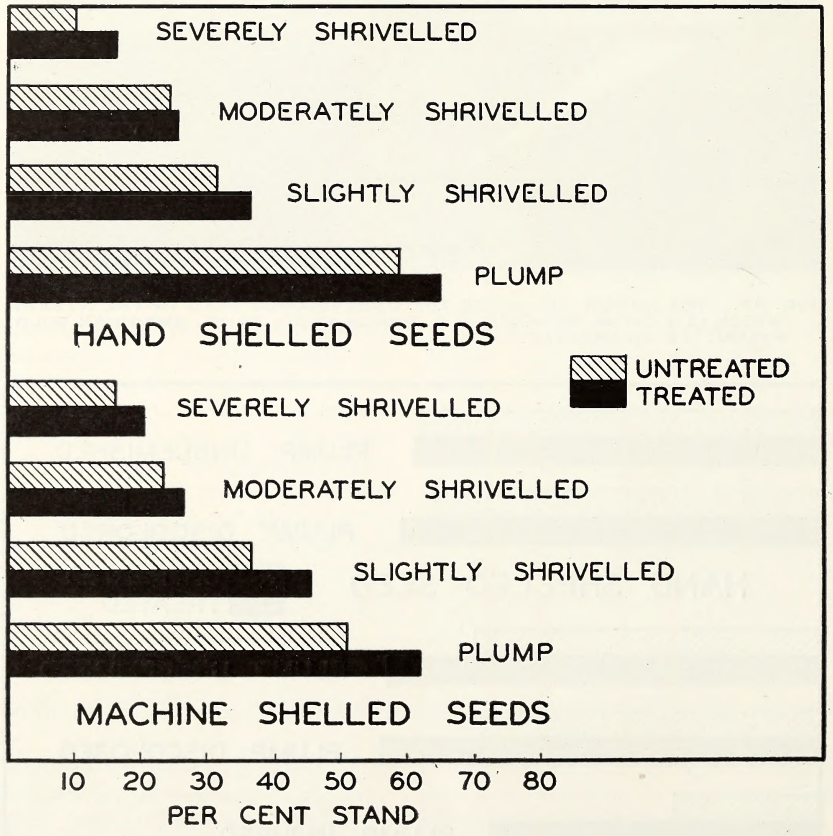


FIG. 31. AVERAGE STANDS OBTAINED IN SIX REPLICATIONS OF 100 HAND-SELECTED SEEDS PLANTED AT UPPER COASTAL PLAINS BRANCH STATION IN 1946. TWO PER CENT CERESAN WAS USED IN SEED TREATMENT.

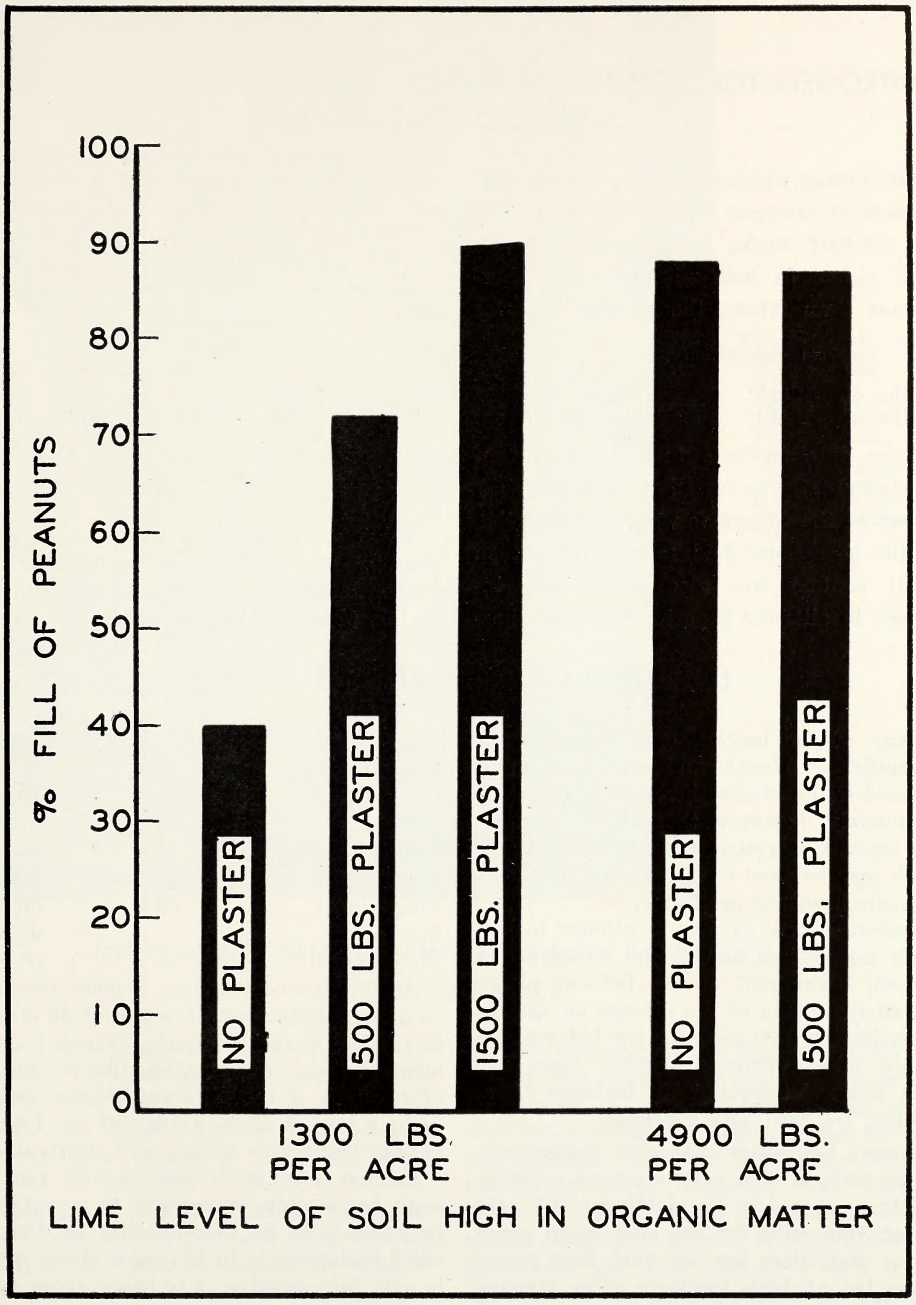


FIG. 32. CALCIUM NEEDS CAN BE MET EITHER BY ADDING SUFFICIENT LIME OR BY ADDING LIBERAL AMOUNTS OF LANDPLASTER. ON THIS DARK SOIL, 500 POUNDS OF PLASTER WAS NOT ENOUGH. EITHER THE ADDITION OF 1500 POUNDS OF PLASTER OR THE ADDITION OF APPROXIMATELY 2½ TONS (4900 LBS.) OF LIME RESULTED IN GOOD QUALITY PEANUTS.

SMALL GRAINS

NITROGEN TOPDRESSING INCREASES PHOSPHORUS AND POTASH CONTENTS OF OATS FORAGE

Oats forage which had received 40 pounds per acre of nitrogen topdressing about two and one-half weeks before sampling was much richer in both nitrogen and phosphorous than where the topdressing was omitted. The oats were about 10 inches high and in the jointing stage when sampled.

The effect of spring nitrogen topdressing on the average yield and composition of oats forage from four experiments is as follows:

Oats fertilization		Lbs. /A of air dry tops			
Fall	Spring		%N	$\%P_2O_5$	$\%K_2O$
250 lbs. of 8-12-12	None	1,886	1.34	.46	2.54
250 lbs. of 8-12-12	40 lbs. nitrogen	2,415	2.72	.81	3.55

These data indicate that nitrogen topdressing greatly increased the nitrogen (N) content of the forage as would be expected, but the phosphoric acid (P_2O_5) and potash (K_2O) content was also consistently increased in all four experiments. The phosphorous content in these soils was fairly high, averaging about 225 pounds per acre of P_2O_5.

The reason for these increases in phosphorous and potash composition is not known, but further work is being conducted on this phase of the problem.

LEMONT OATS RESISTANT TO MOSAIC

Many of the leading oats varieties are susceptible to Mosaic and may have to be replaced if the disease becomes widespread. Fortunately, however, there is a considerable amount of resistant material available which may be used in its present form and in future breeding programs.

Lemont, a new variety mentioned in last year's report, has been found resistant. In 1944-45, 3 per cent of the Lemont plants showed symptoms of the disease as against approximately 100 per cent for Letoria and certain other varieties derived from the cross Lee x Victoria. This includes Lega, Stanton, De Soto, and Florilee.

Lemont has other desirable characteristics as well. It is a very vigorous growing variety as shown by its yielding ability. On test at Statesville for the past seven years and at McCullers for the past four years, it has led at both locations. The average yields for these periods are:

Variety	Yield in bushels per acre	
	Statesville	McCullers
Lemont	85.9	71.6
Lega	78.2	60.9
Letoria	76.0	57.9
Fulwin	74.8	60.7
Lee 5	72.5	59.4
Fulgrain 3	69.5	59.8
Stanton	...	65.6
Victorgrain	...	60.0

As to winter-hardiness, Lemont seems to be quite satisfactory. In a test of 49 strains in 1945-46 at the Mountain Branch Experiment Station, Waynesville, the percentage of survival of the different strains ranged from a low of 23 to a high of 90. Lemont ranked third with 83 per cent survival.

Lemont has resistance to one race of smut but is quite susceptible to crown rust. In addition to its susceptibility to rust, its chief limitation is in having a straw which is only fair, causing it to lodge under some conditions.

FIG. 33. POWDERY MILDEW ON SUSCEPTIBLE BARLEY SELECTIONS. (NOTE COTTONY GROWTH ON LEAVES.) SUNRISE AND SUNRISE X DAVIDSON 2989 ARE RESISTANT TO THIS DISEASE.

INCREASING STIFF-STRAWED WHEATS WITH GOOD YIELDING ABILITY

A preliminary test in 1943-44, followed by two years advanced testing at both Statesville and McCullers during the winters of 1944-45 and 1945-46, shows certain leaf rust resistant selections from the cross Frondoso x (Redhart x Noll) to be outstanding in yield and in ability to stand. Border rows left in the field after harvest have stood perfectly until past the combining stage with no evidence of lodging.

In the four Station tests conducted during this period, three of these selections averaged 30.3 bushels per acre as against an average of 21.4 bushels for the four standard varieties used—Nittany, Leap, Carala, and Redhart. Hardired 5, another leading variety in North Carolina, was slightly lower in production at Statesville but exceeded these new wheats at McCullers. At Statesville leaf rust was more of a limiting factor, while at McCullers both leaf rust and mildew were important. This was es-

pecially true in the spring of 1945. These new wheats have somewhat better resistance to leaf rust than has Hardired, while the reverse is true as concerns mildew.

Considering both the strong straw and leaf rust resistance of these selections, three of them are being multiplied with the expectation of one being distributed in the fall of 1948. This increase work is in cooperation with the N. C. Foundation Seed Producers, Inc.

APPLY NITROGEN TO WHEAT BY MARCH 1

Analysis of wheat plants for nitrogen content at progressive stages of growth shows that nitrogen intake was largest during the period of most growth, March and April, therefore, an adequate supply of nitrogen should be present during that period. This indicates that commercial nitrogen should be applied by the first of March.

When 45 pounds of nitrogen (281 pounds nitrate of soda) was applied at seeding the total amount of nitrogen taken up by the plants was 39 pounds per acre. When the same amount of nitrogen was supplied February 1 the total intake of nitrogen was 62 pounds per acre. When an identical amount was supplied April 1 the total amount of nitrogen taken up was 48 pounds per acre.

When 45 pounds of nitrogen was supplied at seeding, October 20, 1.96 pounds of applied nitrogen (12.3 pounds nitrate of soda) was required to produce a bushel of wheat. When the same amount of nitrogen was supplied February 1 only 1.45 pounds of applied nitrogen (9.1 pounds of nitrate of soda) was required to produce a bushel of wheat. The same rate of application delayed until April 1 required 1.96 pounds of applied nitrogen (12.3 pounds of nitrate of soda) to produce a bushel of wheat. This is further proof that applying nitrogen as a top dressing on wheat by the first of March is more efficient than applying it all at seeding or in late March or early April.

Yield of wheat is controlled by both the number and weight of kernels. These characters are influenced by the stage of growth of wheat plants at the time nitrogen is supplied. For example, the number of kernels and weight per kernel were increased by more nitrogen topdressing February 1 than with the same amount of nitrogen applied at seeding or topdressed as late as April.

DISEASE RESISTANT BARLEYS

Davidson (bearded) and Hooded 26 barleys are resistant to loose smut but very susceptible to mildew (Fig. 33); Sunrise (short awned) is just the oposite. Because of its good yields and near awnless heads, Sunrise has become the most popular variety grown in North Carolina. For the seven-year period 1938-1944, the average yields of these three varieties on the Piedmont Branch Station, Statesville, were: Sunrise 58.8; Davidson, 52.7; and Hooded 26, 44.9 bushels per acre.

With severe leaf rust conditions existing in 1945 and again in 1946 Sunrise has, however, toppled from top rank in yield in the Experiment Station and Official Variety Tests. Both Sunrise and Hooded 26 have suffered far more than has Davidson, which has brought out the fact that the latter variety has some tolerance to this disease. The average yields at Statesville for these two years were: Davidson, 47.0; Hooded 26, 32.5; and Sunrise, 27.4. This reversal in the yields of Sunrise and Davidson shows clearly the importance of resistance to a disease such as rust when this disease is present.

In an attempt to combine resistance to all three of these diseases, numerous crosses have been made and many selections isolated from these hybrid populations. The most promising strain obtained to date is

No. 2989 from a cross of Sunrise x Davidson. Including both Experiment Station and Official Variety Tests, No. 2989 led in yield in 1945-46. It ranked first in six out of eight tests, second in one and third in the other.

S x D 2989 seems to be as resistant to mildew as Sunrise and as tolerant to rust as is Davidson. No inoculation tests to determine its reaction to loose smut have been made, but in the four years it has been under observation only a trace of smut has been found. It is a short, stiff strawed selection, standing well until fully mature. Initial increases were made in 1946-47.

SOYBEANS

HIGHER SOYBEAN YIELDS POSSIBLE

Experiments conducted the past several years in farmers' fields have shown that the following factors are important in obtaining high yields of soybeans **(Fig. 34)**:

- Liming with dolomitic limestone in accordance with requirements as shown by soil tests.
- Fertilizing with adequate amounts of phosphorus and potash.
- Planting and securing a good stand of an adapted variety.

In 1946 to show clearly these important practices in the production of soybeans, nine tests were set up in farmers' fields in Pasquotank, Beaufort, Jones, Duplin, Edgecombe and Halifax counties.

The data from these experiments showed the importance of lime and fertilizer very clearly **(Fig.35)**. These results point out that the addition of lime alone or fertilizer alone is not sufficient.

Soils now producing very low yields can be made to produce well. The results shown in **Figure 36** support this conclusion. The quality of the beans was also much improved by the lime and fertilizer.

In an experiment in Pasquotank County a yield of 42 bushels was obtained for the Ogden variety with no lime or fertilizer. Ordinarily it would be thought that with a yield such as this no additional nutrients would be needed. The results shown in **Figure 37** were obtained when lime and fertilizer were used, however.

THE DEVELOPMENT AND TESTING OF SOYBEAN VARIETIES

Soybean variety trials continue to show Ogden and Roanoke to be the varieties best adapted for seed production. The Ogden variety has expanded rapidly since it was introduced in 1943, and is now the favorite variety in the Tidewater area. A limited amount of seed of the variety Roanoke was released to farmers in the spring of 1946.

This variety matures in late October, approximately two weeks later than Ogden and one week earlier than Wood's Yellow. Roanoke is superior in oil content and seed holding to all other varieties adapted to North Carolina conditions, but has a greater tendency to lodge than does Ogden. Lodging is most likely to be a problem on the heavier soils. Both Roanoke and Ogden will usually surpass the older varieties in seed yield, but yield is very closely associated with nutrient level. No variety can be expected to give a satisfactory seed yield if an adequate supply of plant nutrients is not present.

A rather extensive breeding program is in progress to develop even better varieties than those now recommended. During the past season approximately 400 new strains, all selections from crosses, were grown in replicated yield trials. The most promising of this material is of Ogden maturity and has Ogden as one parent. These strains have produced yields similar to Ogden, but are superior in seed holding and have higher seed quality.

SOYBEANS ARE BENEFITED BY IRISH POTATO FERTILIZER

Soybeans planted June 15 after an early crop of Irish potatoes were benefited by the phosphate and potash applied to the potatoes. The experiment was conducted in Eastern North Carolina on a potato soil rather low in available potash and phosphate.

When a 6-0-10 fertilizer at the rate of one

ton per acre was used on the potatoes a yield of 24 bushels per acre of soybeans was obtained. With a 6-8-10 fertilizer on the potatoes the beans yielded 37 bushels.

The potash in the potato fertilizer also affected the soybean yields. With a 6-10-0 the yield of soybeans was 24 bushels while a 6-10-9 on the potatoes produced 36 bushels of soybeans.

These data indicate that the high fertilization of Irish potatoes takes care of the fertilizer needs of the following crop of soybeans.

SOYBEAN SEED TREATMENT INCREASES STAND

Tests were conducted to determine the influence of fungicidal chemical treatment of soybean seed on emergence and stand. Four lots of soybean, each representing a different variety, grown in 1945 were treated in the spring of 1946. Five kinds of seed treatment chemicals were used on each lot of seed. Each chemical was used at three dosages: one, two, and three ounces per bushel of seed. Seed of the four varieties, Rose Non-Pop, Volstate, Roanoke, and Wood's Yellow, differed considerably in the percentage of diseased seeds.

Plantings were made as follows: at the McCullers Branch Station on April 29, at the Upper Coastal Plains Branch Station, Rocky Mount, and the Tidewater Branch Station, Plymouth, on May 9.

High percentage stand increases from seed treatment occurred at Rocky Mount where the seed were planted in heavy, poorly drained soil. Only small increases resulted from seed treatment at Plymouth and McCullers where the treated seeds were planted in better drained soils.

Treatment of the Rose Non-Pop seed resulted in larger stand increases at all locations than treatment of the other three seed lots. It is of interest to note that this same variety also contained the highest percentage of diseased seeds. This difference in diseased seed content was sufficiently great, however, to account for only a small portion of the increase due to seed

FIG. 34. A TYPICAL SOYBEAN FERTILITY EXPERIMENT IN WHICH IT HAS BEEN SHOWN THAT THE AVERAGE STATE SOYBEAN YIELD CAN BE MORE THAN TRIPLED WITH THE USE OF A GOOD LIMING AND FERTILIZATION PROGRAM ALONG WITH GOOD STANDS OF ADAPTED VARIETIES.

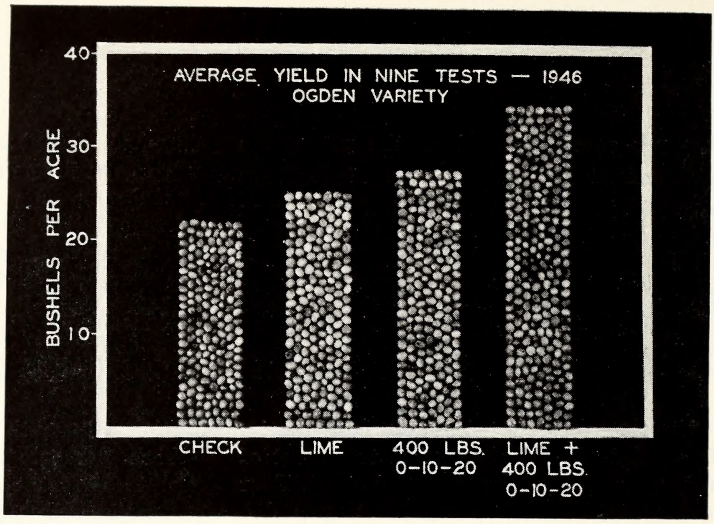


FIG. 35. LIME AND FERILIZATION WITH 400 POUNDS OF 0-10-20 INCREASED THE YIELDS OF SOYBEANS TO 34 BUSHELS PER ACRE. (AVERAGE OF NINE EXPERIMENTS IN 1946.)

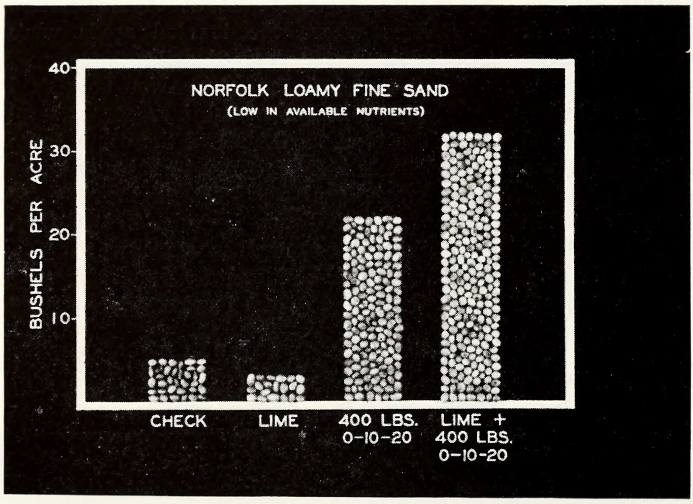


FIG. 36. THE SOYBEAN YIELDS WERE INCREASED FROM 5 BUSHELS PER ACRE ON THE CHECK PLOT TO 32 BUSHELS WHEN LIME AND FERTILIZER WERE APPLIED ON THIS INFERTILE NORFOLK LOAMY FINE SAND IN EDGECOMBE COUNTY.

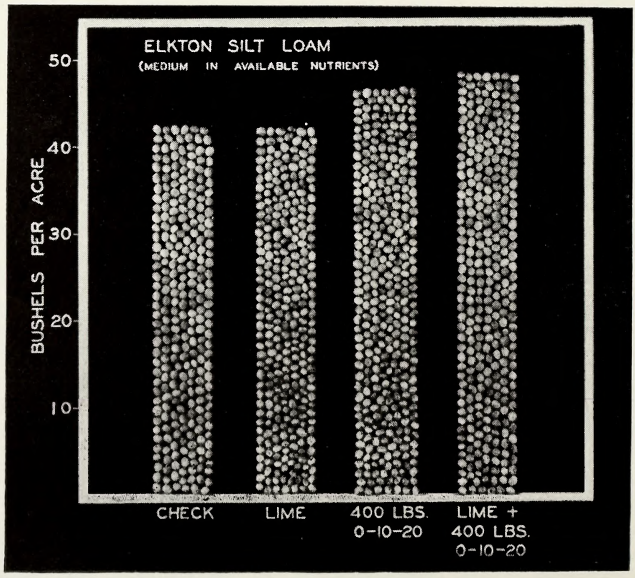


FIG. 37. EVEN WITH HIGH YIELDS OF OGDEN SOYBEANS LIME AND FERTILIZER INCREASED THE YIELD 6 BUSHELS PER ACRE (PASQUOTANK COUNTY.)

treatment. The treatments appear to have protected the seeds not only from early destruction by seed-inhabiting fungi but also from soil-infesting parasites.

In general, the two-ounce per bushel dosage gave slightly better protection to the seed than the one-ounce dosage but three ounces was usually not significantly better than two. **Figure** 38 shows rows planted to treated and untreated seed at Rocky Mount.

Increases in stands ranging from 200 to 1000 per cent were obtained from treatment of four lots of two-year-old seed of the varieties Ogden and Volstate in two plantings made at Rocky Mount. Seedling emergence from the two-year-old untreated seed ranged from 4 to 15 per cent of the seeds planted while 33 to 81 per cent of the treated seeds came up. In these two plantings of Ogden and Volstate seed made at Rocky Mount on April 19 and May 31 and in the plantings of Rose Non-Pop, Roanoke, Volstate and Wood's Yellow made at Rocky Mount on May 9 seed treatment saved enough plants to give a satisfactory stand of young plants when the stand from untreated seed was too poor to save.

SOYBEAN CATERPILLARS STOPPED BY DDT AND BENZENE HEXACHLORIDE DUSTS

A number of different species of caterpillars present an annual menace to soybeans in the eastern counties of North Carolina particularly in Hyde and Tyrrell counties. The velvet bean caterpillar, which spreads north from the states south of

FIG. 38. PLANTS OF ROSE NON-POP GROWING FROM UNTREATED SEED (3) AND TREATED SEED (4) AT THE UPPER COASTAL PLAIN BRANCH STATION, ROCKY MOUNT.

North Carolina, and the corn earworm, which leaves mature corn for the greener and more succulent soybean foliage, attack soybeans at about the same time in late August. Other caterpillars attack soybeans at the same time but these are the most abundant and most ravenous feeders.

The velvet bean caterpillar feeds on the foliage, first eating the top leaves and then stripping the plant as it devours the leaves. The corn earworm attacks the pods and may bore into them, eating the seed.

Soybeans that are not to be used for hay or feed may be protected from the ravenous attacks of caterpillars by one timely application of 5 per cent DDT dust. This should be applied just as soon as the small larvae begin to be numerous on soybean foliage. Small, young larvae are difficult to find on soybean foliage not only because of their size but also because their color blends with that of the foliage. By shaking the foliage over a plain piece of paper, the larvae are dislodged and their abundance estimated, despite the fact that their feeding may not as yet have materially damaged the foliage. Dusting the foliage with 5 per cent DDT at the rate of 20-25 pounds per acre has given complete control of most species of soybean caterpillars. Benzene hexachloride dust, gamma isomer content 5 per cent, is just as effective as 5 per cent DDT dust and may be suitable for use in areas where the foliage is to be used as hay.

POWDERY MILDEW OF SOYBEANS IDENTIFIED

A powdery mildew disease has recently been identified on soybeans in North Carolina. It was first found on field-grown soybeans in Surry County, North Carolina in 1944. The same disease was found at several locations in Eastern North Carolina in 1945 and again in 1946. This soybean powdery mildew fungus belongs to the genus *Microsphaera* and in this respect resembles the powdery mildew occurring rather commonly on lespedeza. Thus far, the soybean mildew has appeared late in the summer and caused little damage. Greenhouse studies show, however, that when temperature and moisture conditions are favorable the fungus can cause serious damage to soybeans. The varieties Tokio, Ralsoy, Ogden and Herman are susceptible to this powdery mildew. Roanoke, Volstate, Haberlandt and Wood's Yellow are highly resistant.

TOBACCO

PRIMING IMPROVES YIELD AND QUALITY OF BURLEY TOBACCO

Priming and cutting as methods of harvesting burley tobacco were compared in an experiment which involved five treatments: (a) All cut in the normal way; (b) One priming made, approximating the flyings; balance cut; (c) Two primings made approximating the flyings, lugs, and leaf; balance cut; and (e) All primed in four primings.

Increased yields resulting from primings, when compared with all cut, ranged from about 200 pounds per acre with one priming to about 400 pounds per acre when it was all primed. It is believed that two factors were involved in the increased yield resulting from priming. A few leaves on the lower part of the plant that are ordinarily lost by firing when the tobacco is cut were saved by priming. This evidently resulted in more weight being produced by the leaf on the upper portions of the plant. Increased acre values from priming were due primarily to increased yields. However, there was a distinct tendency toward higher quality in the leaf and tip grades when primed.

EFFECTS OF ROW AND DRILL SPACINGS ON BURLEY

Plant spacings of 12, 15, and 18 inches in the drill were tested on rows 3 feet and four inches, 4 feet, and 5 feet apart. No differences in either yield or value resulted from varied drill spacings at any of the row widths. No differences of any significance in either yield or value occurred between the 3 feet and four inches, and 4 feet row widths. However, both yield and value did drop significantly at the five feet row width.

NEW BURLEY VARIETIES TESTED FOR YIELD AND QUALITY

Approximately 20 varieties and strains of burley tobacco at the Branch Station at Waynesville were grown and evaluated for both yield and quality in 1945 and 1946 **(Fig. 39)**. Most of the variety material assembled consists of the more promising strains developed at the Kentucky and Tennessee Agricultural Experiment Stations. The primary objective in developing these new strains was to combine black root rot resistance with high yields of superior quality tobacco. Kentucky 16 and Judy's Pride were used as control root rot resistant and root rot susceptible varieties, respectively, in variety tests in North Carolina.

Among the newer strains, Tennessee 6, Kentucky Nos. 19, 21, and 41A have been equally as good in both yield and quality as Kentucky 16. On soil moderately contaminated with the black root rot parasite, all the resistant lines have distinctly outyielded Judy's Pride.

STUDIES ON AROMATIC TOBACCOS IN PROGRESS IN WESTERN NORTH CAROLINA

Studies on the production of aromatic (Turkish) types of tobacco were begun in Western North Carolina in 1945 at the Branch Experiment Stations located at Waynesville and Laurel Springs. Experiments are underway on the following fac-

tors involved in the production of this type of tobacco: (1) Measurements of the yield and quality of different types and varieties of aromatic tobacco under conditions of the relatively high altitude, rainfall, and short growing season prevailing in Western North Carolina. (2) The effects of varied levels of phosphate, varied dates of transplanting, and varied row and drill spacings on rate of maturity, yield, and quality.

These tests, while not advanced to the point that definite conclusions can be drawn concerning many of the objectives sought, have shown that aromatic types of tobacco will make satisfactory growth and yield under Western North Carolina conditions provided care is used in selecting soil of suitable type and fertility. Furthermore, the quality of the leaf produced can be of good to excellent quality provided it is handled properly during the harvesting, curing, and storage periods.

EFFECT OF CHLORINE IN TOBACCO FERTILIZERS

The effects of chlorine applied at rates of 20, 40, and 60 pounds per acre, upon yield and quality of tobacco, were studied at 10 locations in 1946, and in two of these the additional rates of 0 and 80 pounds per acre were included. Five experiments were in the Coastal Plain and five in the Piedmont. A wide range of soil and climatic conditions was encountered.

One fact regarding appearance of the plants throughout the season is worthy of mention. In none of these experiments, even

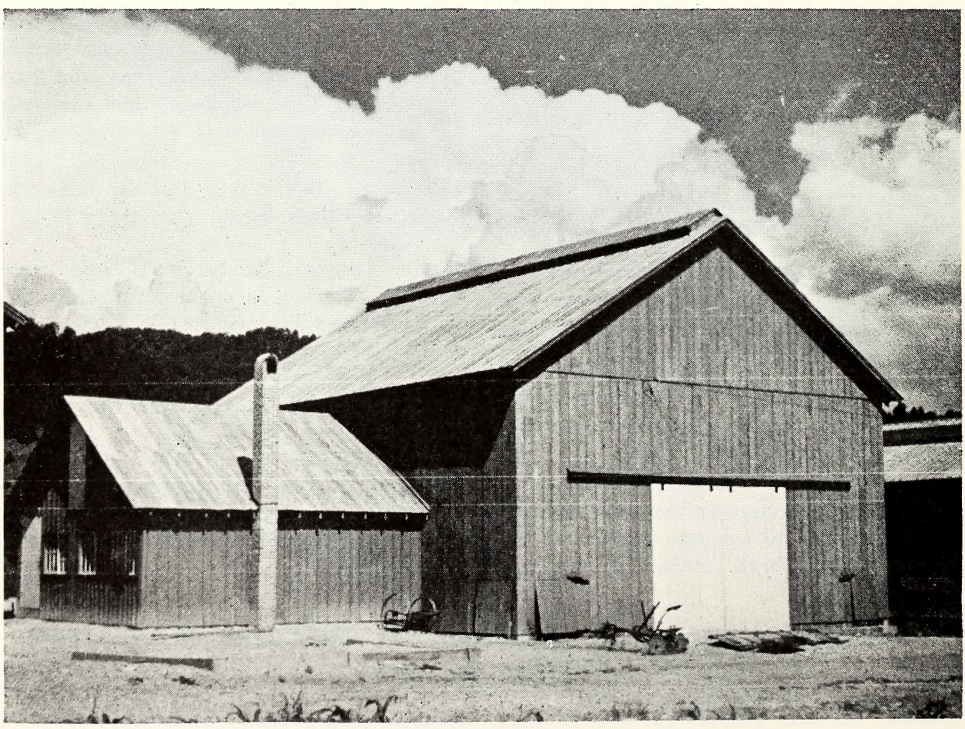


FIG. 39. CURING BARN FOR BURLEY TOBACCO AT THE MOUNTAIN BRANCH STATION, WAYNESVILLE, NORTH CAROLINA.

those where 80 pounds of chlorine per acre was used, did the plants exhibit marked symptoms of injury. In about half the experiments a slight thickening of the leaves of the high chlorine plots was noticeable at some time during the early period, but this was not marked and disappeared as growth continued. The effect of chlorine upon yield was slight.

The chlorine contents of the cured leaves from two of the Coastal Plain experiments and two of the Piedmont experiments are presented graphically in **Figure 40.** Two facts are important. A wide range in chlorine levels of the leaves from the different locations is evident, and in every case the chlorine content was increased by the increased applications of this element. The high chlorine content of the leaves results in tobacco of poorer burning quality. The effects of such substances as nitrogen, potassium, and calcium upon the specific influence of chlorine are being studied. Also, the effects of chlorine upon a number of chemical properties of the cured leaf such as sugar content, nicotine content, and nitrogen fractions are being determined.

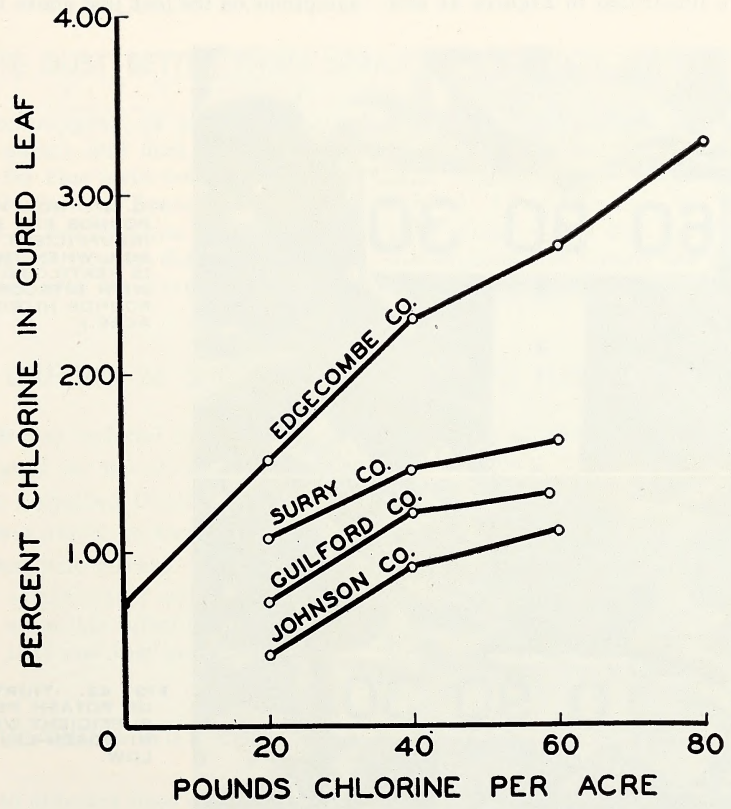


FIG. 40. THE CHLORINE CONTENT OF THE CURED TOBACCO LEAF IS INCREASED AS THE AMOUNT ADDED TO THE SOIL IS INCREASED, AND THE LEVEL OF CHLORINE IN THE PLANT VARIES FROM ONE LOCATION TO ANOTHER.

CONDUCT TOBACCO VARIETY TEST IN COASTAL PLAIN

Sixteen tobacco varieties were tested on disease free soil at the Upper Coastal Plain Branch Station in 1946. Yields varied widely. Bottom Special, 402, 401, 400, and Yellow Special headed the list, with yields of 1429, 1403, 1388, 1325, and 1316 pounds per acre, respectively. Highest values per acre were also obtained from these five varieties, a large percentage of the leaves falling in the best lug and cutter groups. In the second best group were Oxford 1, Gold Dollar, Oxford 26, Oxford 3, and Virginia Bright Leaf. Yields of these varieties were 1164, 1159, 1138, 1128, and 1119 pounds per acre, respectively.

BALANCE OF NITROGEN AND POTASH IMPORTANT

Proper balance between rates of nitrogen and potash must be maintained if tobacco of high quality is produced. Two extreme conditions are illustrated in **Figures 41** and **42**. In **Figure 41**, it will be seen that 30 pounds of potash was inadequate as evidenced by the marked potash deficiency symptoms on the leaf just above the "90". In

FIG. 41. HOW POTASH (30 POUNDS PER ACRE) IS INSUFFICIENT ON THIS SOIL WHEN THE TOBACCO IS FERTILIZED HEAVILY WITH NITROGEN (60 POUNDS NITROGEN PER ACRE.)

FIG. 42. THIRTY POUNDS OF POTASH PER ACRE IS SUFFICIENT WHEN NITROGEN LEVEL IS VERY LOW.

Figure 42, where the nitrogen level was low and growth was poor, no potash deficiency symptoms are seen. Although these cases are extremes, they serve well to illustrate the danger of too low a potash supply on soils well supplied with nitrogen, whether the nitrogen comes from added fertilizer, a green manure crop, or a naturally fertile soil. The yield may be increased by the use of nitrogen alone but unless the potash supply is increased along with the nitrogen, low quality tobacco will be produced.

DUAL PURPOSE SPRAY FOR FLEA BEETLES AND BLUE MOLD

DDT can be combined with Fermate (ferric dimethyl dithiocarbamate) to form an effective mixture for the control of flea beetles and blue mold. Preliminary field trials have indicated that the combination spray containing approximately one pound of DDT and three pounds of Fermate in 100 gallons of water, applied in accordance with the recommendation for control of blue mold, will provide excellent protection from both flea beetle injury and blue mold.

FERMATE DUST BETTER THAN SPRAY IN CONTROL OF BLUE MOLD

The Fermate spray (4 pounds per 100 gallons of water) and dust (15 per cent) treatments for blue mold control were compared at McCullers Branch Experiment Station and at five locations in Wake County. In Columbus County the Fermate dust was compared with the Fermate spray and with the Paradichlorobenzene (P.D.B.) treatment. The number of applications at each location of each material varied from 6 to 10. At all locations the Fermate dust gave better control that the Fermate spray and in Columbus County the dust treatment gave control equal to the P.D.B. treatment.

OXFORD 26 SHOWS RESISTANCE TO FUSARIUM WILT

Oxford 26 was included in the Fusarium resistance plots at McCullers Branch Station and in Columbus County in 1945 and 1946, and was found to have resistance to the Fusarium wilt disease. The plants developed no symptoms of wilt early in the season, but some late infection was evident. During the 1945 and 1946 seasons, however, practically all the tobacco was harvested before any plant showed symptoms of the disease.

In the 1946 test, Oxford 26 produced almost four times as much tobacco per acre as Gold Dollar under severe disease conditions. The quality of the tobacco from Oxford 26 was much better than that from Gold Dollar.

FUSARIUM WILT RESISTANT TOBACCOS SHOW PROMISE

In 1946, 40 different lines of tobacco were tested at the McCullers Branch Experiment Station and at Whiteville for Fusarium wilt resistance. A few lines which showed rather high resistance to Fusarium wilt had flue-cured type and produced average yields of high quality tobacco.

FIG. 43. TOBACCO GROWING IN ONE OF A SERIES OF PLOTS ESTABLISHED AT THE OXFORD STATION IN 1911. FERTILIZER TO SUPPLY 20, 90, AND 60 POUNDS OF NITROGEN, PHOSPHORIC ACID, AND POTASH RESPECTIVELY HAS MAINTAINED A HIGH YIELD AND VALUE PER ACRE----1,409 LBS. AND $440 PER ACRE, RESPECTIVELY, AS AVERAGE FOR SIX LATE YEARS. SOYBEANS ARE PLOWED UNDER ONE YEAR AHEAD OF TOBACCO IN A THREE YEAR ROTATION.

FIG. 44. NITROGEN HAS BEEN OMITTED FROM THE FERTILIZER APPLIED TO THE TOBACCO IN THIS PLOT, BUT YIELDS HAVE BEEN REDUCED ONLY SLIGHTLY (AVERAGE OF 1,175 POUNDS PER ACRE FOR THE PAST SIX YEARS). NITROGEN FROM THE SOYBEANS HAS BEEN NEARLY SUFFICIENT FOR MAXIMUM YIELDS AND RETURNS PER ACRE ($366 PER ACRE).

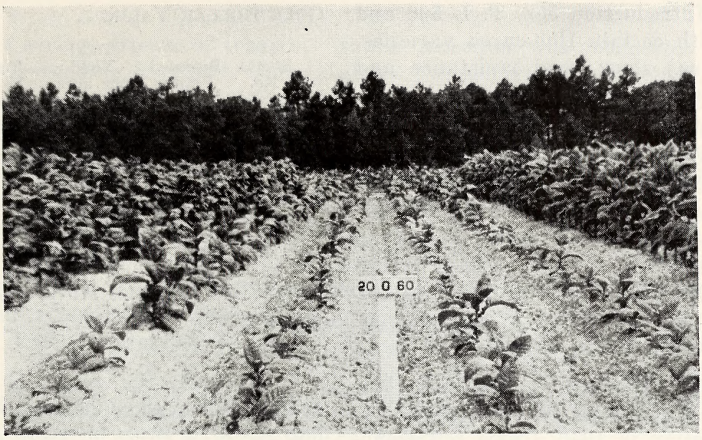


FIG. 45. THIS PLOT, ONE OF THE SAME SERIES ESTABLISHED AT THE OXFORD STATION IN 1911, HAS RECEIVED ON PHOSPHORUS FOR 35 YEARS, BUT NITROGEN AND POTASH AS INDICATED. YIELDS AVERAGE 790 POUNDS PER ACRE, AND QUALITY HAS BEEN LOW ($207----AVERAGE VALUE PER ACRE).

FIG. 46. POTASH HAS BEEN OMITTED FROM THE FERTILIZER APPLIED TO THIS PLOT SINCE 1911. YIELDS HAVE BEEN FAIRLY HIGH (1,128 POUNDS PER ACRE FOR THE LAST 6 YEARS) BUT QUALITY HAS BEEN LOW AS EVIDENCED BY AN AVERAGE VALUE PER ACRE OF $318.

The three most desirable lines are selections in fifth generation of first backcross of Tobacco Introduction 552, T. I. 566 and T. I. 806 with certain flue-cured varieties. All three lines show good resistance and produce average yields of high quality tobacco. A few notes on how these three strains compare with a susceptible variety such as Gold Dollar from the standpoint of yield, value, quality and resistance are given in Table 2.

TABLE 2. FIELD PERFORMANCE OF FUSARIUM WILT-RESISTANT LINES COMPARED WITH GOLD DOLLAR VARIETY.

1946 Strain No.	Diseased Plants	Total Yield per acre	Total Value	Good Tobacco
8	10.2%	919.8 lbs.	$471.17	78.0%
27	36.3%	1029.4 lbs.	$534.32	82.7%
28	39.8%	905.0 lbs.	$442.43	70.8%
Gold Dollar	96.7%	274.2 lbs.	$134.30	73.0%

CROP ROTATIONS CUT DAMAGE FROM ROOT KNOT AND MEADOW NEMATODE

The two- and three-year crop rotation test was continued at the McCullers Branch Experiment Station in 1946. Crops represented included: corn, cotton, crotalaria, peanuts, oats and weeds, and continuous tobacco.

The most outstanding three-year rotation is arranged so that cotton is planted the first year, peanuts the second and tobacco the third. This cropping sequence in comparison with continuous tobacco increased the yield of tobacco almost 400 pounds per acre, reduced the root knot index to almost 0, and reduced the meadow nematode 45 per cent.

A cropping sequence where corn is planted the first year, oats and weeds the second and tobacco the third is also outstanding. This rotation increased the yield and decreased the root knot and meadow nematode when compared with continuous tobacco. Table 3 contains data on the three-year rotations.

In general, the two-year rotations decreased the meadow nematode and root knot, but had little effect on yield. A cropping sequence of peanuts-tobacco increased the yield about 150 pounds per acre. Other two-year rotations that are much better than continuous tobacco are corn-tobacco and oats and weeds-tobacco. A two-year rotation of crotalaria-tobacco increased the yield 300 pounds per acre, but the quality was very poor.

The crop that precedes tobacco is of great importance in planning a cropping sequence for root knot and meadow nematode control. Results show that a rotation of cotton-peanuts-tobacco produced almost 400 pounds more tobacco per acre than a rotation of peanuts-cotton-tobacco. These results indicate that cotton is a good crop to include in a rotation, providing an intervening crops such as peanuts, oats and weeds, weeds or corn is grown between the cotton and the tobacco.

TABLE 3. THREE-YEAR ROTATION TEST AT MCCULLERS BRANCH STATION SHOWING YIELD AND DISEASE INDEX OF TOBACCO.

Crops Planted			Total Yield	Disease Index*	
1944	1945	1946	(Per Acre)	Root Knot	Meadow Nematode
Peanuts	Cotton	Tobacco	545 lbs.	3.0	45
Cotton	Peanuts	Tobacco	905 lbs.	0.3	36
Corn	Oats & Weeds	Tobacco	871 lbs.	8.3	16
Cotton	Weeds	Tobacco	795 lbs.	2.4	23
Weeds	Weeds	Tobacco	755 lbs.	10.7	15
Tobacco	Tobacco	Tobacco	553 lbs.	71.6	81

* On the disease index scale, 0 represents no infection and 100 represents maximum infection. This figure is obtained by classifying the tobacco roots according to the degree of infection.

SPREAD OF BLACK SHANK MAY RESULT FROM WINDBLOWN SPORES

Black shank, a serious disease of tobacco, has been slowly spreading in North Carolina. The disease is known to be introduced into new areas by movement of infected soil or infected plants and by surface water. Evidence has been reported by some research workers which strongly suggests that the disease may be spread also by wind-borne spores. Additional observational evidence suggesting this fact was obtained last season at the Oxford Branch Station.

A single leaf lesion suggestive of black shank infection was collected 18 inches above the soil on July 9, 1946, following several days of rainy weather. The fungus when isolated and inoculated into tobacco cuttings proved to be black shank.

The field in which the isolated infection occurred was located about half a mile from the nearest known black shank-infected tobacco. There had been no exchange of farm machinery or tobacco plants between farms and there was no opportunity for the infection to be carried by surface water.

DEEP APPLICATION OF UREA AND CYANAMID FOR WEED CONTROL UNSATISFACTORY

Studies were conducted at the Tobacco Branch Station, Oxford, and at the McCullers Branch Station to determine the effectiveness at various soil depths of the combination Uramon-cyanamid treatment of tobacco beds. Within several weeks after sowing, soil layers one inch in depth down to four inches were carefully removed from treated and untreated beds, brought into the greenhouse in clean wooden trays, and kept carefully watered. Weed seedlings were allowed to grow out and at the end of four weeks the weed population in each soil sample was counted.

Using the layers of soil from untreated beds as checks and considering the seedling population from such layers as 100 per cent, corresponding layers of soil from the treated beds gave the following percentages of weeds at the various levels: 0-1 inch, 2 per cent; 1-2 inches, 1 per cent; 2-3 inches, 8 per cent; and at 3-4 inches, 19 per cent.

These results aid in explaining why somewhat unsatisfactory weed control sometimes results in chemically treated plant beds if the soil is stirred too deeply at planting time.

GRANVILLE WILT REDUCED BY CROP ROTATION

Data have been obtained for wilt infection on tobacco grown in rotations with bare fallow, soybean and corn in a replicated test conducted for the past six years in Granville County. The 1944-'5-'6 average for tobacco grown after tobacco was 95 per cent wilt. During this same period, wilt infection in tobacco grown after one year of bare fallow, soybeans and corn averaged 78, 83, and 72 per cent, respectively. Tobacco grown after three years of soybeans or corn averaged 33 and 28 per cent wilt, respectively, during the same period. Counts of wilted plants were made August 1 to 15 of each year. These results show that the length of time between tobacco crops was a major factor in determining the effectiveness of crop rotation for wilt control.

HORTICULTURAL CROPS

SMALL FRUITS

STRAWBERRIES NEED SMALL AMOUNTS OF MANGANESE AND ZINC

Controlled greenhouse studies have shown that the strawberry, like many other crops, requires small amounts of manganese and zinc for normal growth. Plants of the variety Massey, when grown with their roots in highly purified nutrient solutions, made excellent growth if all the known essential elements were supplied. When manganese and zinc were withheld, growth was retarded and distinct changes took place in the appearance of the leaves.

Omission of manganese resulted in pale green to yellow coloration of the interveinal areas, while all the veins of the leaf remained green. **(Fig. 47).** This effect was usually more pronounced in mature leaves than in younger ones. The shape of the leaf was not affected.

Omission of zinc gave rise to a different pattern. The younger leaves were pale green to yellow except for the larger veins and a narrow border at the margin, which remained greener. **(Fig. 48).** The leaf-blade was somewhat narrow and concave. Although the leaves unfolded normally, both blades and petioles grew slowly or not at all, so that there was accumulation of many stunted leaves on older plants. **(Fig. 49).** After spraying the foliage with a dilute zinc sulfate solution the leaves turned green and growth was resumed within two weeks.

RESULTS OF STRAWBERRY VARIETY TESTS

At the McCullers Experiment Station, NC 1012 outyielded Blakemore, Dorsett, Fairmore, and Maytime in the group of early-maturing varieties of strawberries. Of the second-early varieties, Midland and Missionary produced greater yields than Fairfax. In the midseason group, Tennessee Shipper and Tennessee Supreme produced greater yields than Massey, but the berries were small, and those of Tennessee Supreme were exceptionally soft. Massey and Midland produced the largest berries and the highest percentage of U. S. No. 1's of all varieties tested during the 1946 season.

Of six varieties and four selections tested for two years at both McCullers and Willard, NC 1012 produced significantly greater yields than Blakemore, Dorsett, Fairfax, Fairmore, Massey, Maytime, and NC 1020. For this same period, the average yields of NC 1033 and NC 1039 were equal to those of Blakemore, Fairfax, and Massey. The largest berries were produced by Massey and NC 1020, and the smallest by Blakemore.

COPPER TESTED FOR CORRECTING DIEBACK OF BLUEBERRIES

Further attempts were made in the summer of 1946 to diagnose a "dieback" disorder of blueberry by the application of foliage sprays. At Ivanhoe, North Carolina, dilute solutions of salts of copper, manganese, zinc, boron, molybdenum, and iron, individ-

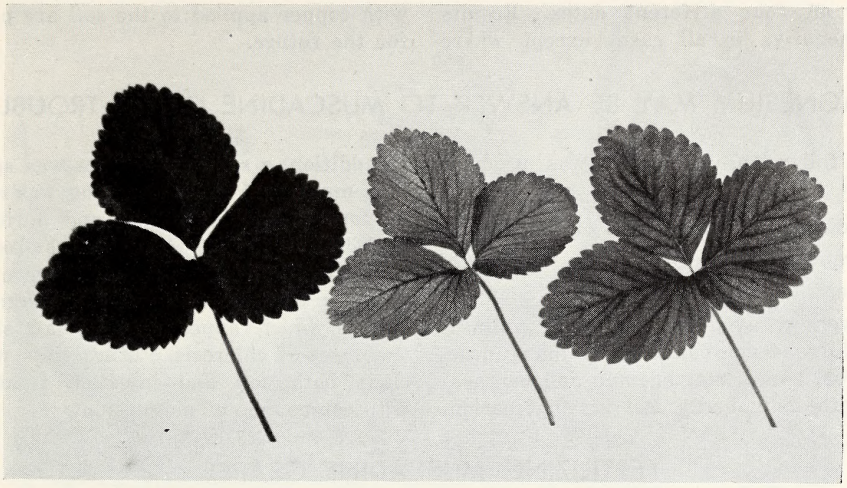


FIG. 47. DEFICIENCY OF MANGANESE IN THE STRAWBERRY PLANT CAUSES YELLOWING OF THE LEAF BETWEEN THE VEINS (CENTER AND RIGHT) AS COMPARED WITH THE UNIFORM GREEN OF THE NORMAL LEAF (LEFT).

FIG. 48. DEFICIENCY OF ZINC IN THE STRAWBERRY PLANT CAUSES STUNTING AND YELLOWING OF ALL THE LEAF EXCEPT THE LARGE VEINS AND THE MARGIN (RIGHT) AS COMPARED WITH THE UNIFORM GREEN OF THE NORMAL LEAF (LEFT).

ually and in combinations were sprayed on the leaves of ailing bushes of Rancocas variety on four different dates. Results were negative in all cases except where copper alone was applied, and response to this treatment was slight. Further tests with copper applied to the soil are planned for the future.

MAGNESIUM MAY BE ANSWER TO MUSCADINE GRAPE TROUBLE

The foliar spray method was used at Willard in tests for the cause of a chlorosis which develops in the leaves of the Muscadine grape. The variety James is particularly susceptible. Vines of James and Scuppernong were sprayed with solutions containing soluble forms of copper, manganese, zinc, iron, boron, molybdenum and magnesium, both individually and in combination. In addition, a solution of urea was sprayed on a number of vines. Spraying was repeated four times just before and during the period of fruit ripening, when chlorosis becomes most prominent. Results were negative for all treatments except magnesium sulfate which appeared to delay slightly the onset of chlorosis. Future tests will include both soil and injection treatments with compounds of magnesium.

FERTILIZING MUSCADINE GRAPES

At the Coastal Plain Experiment Station, Willard, 96 selected vines in a vineyard of Thomas variety were subjected to eight different fertilizer treatments, on both cultivated and uncultivated areas. Levels of 6-8-5 fertilizer ranged from 500 to 1500 pounds per acre. Furrow application was compared with broadcast for a level of 1000 pounds per acre. Phosphate was omitted in one treatment and potash in another. There were no visible differences in resultant growth and estimated yields of grapes for any treatments. Unfertilized vines ap-

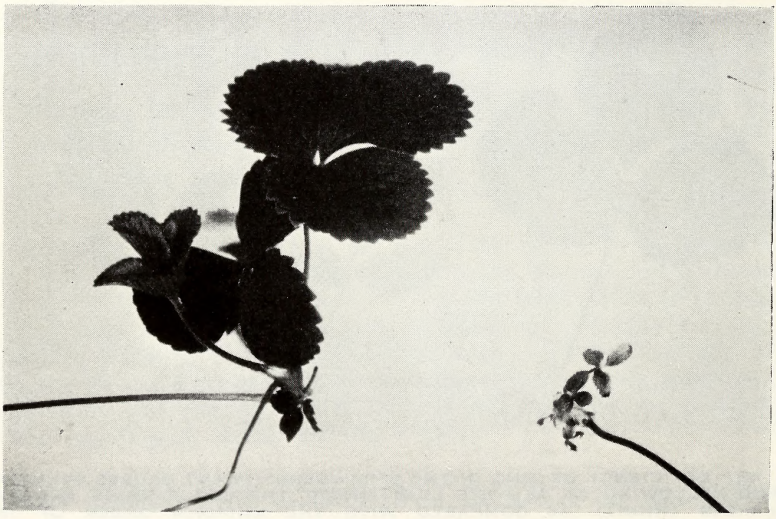


FIG. 49. THE LEAVES OF RUNNERS ON A ZINC-DEFICIENT STRAWBERRY PLANT ARE STUNTED AND CHLORITIC (RIGHT) AS COMPARED WITH THE EXCELLENT GROWTH AND COLOR OF LEAVES ON A NORMAL RUNNER (LEFT).

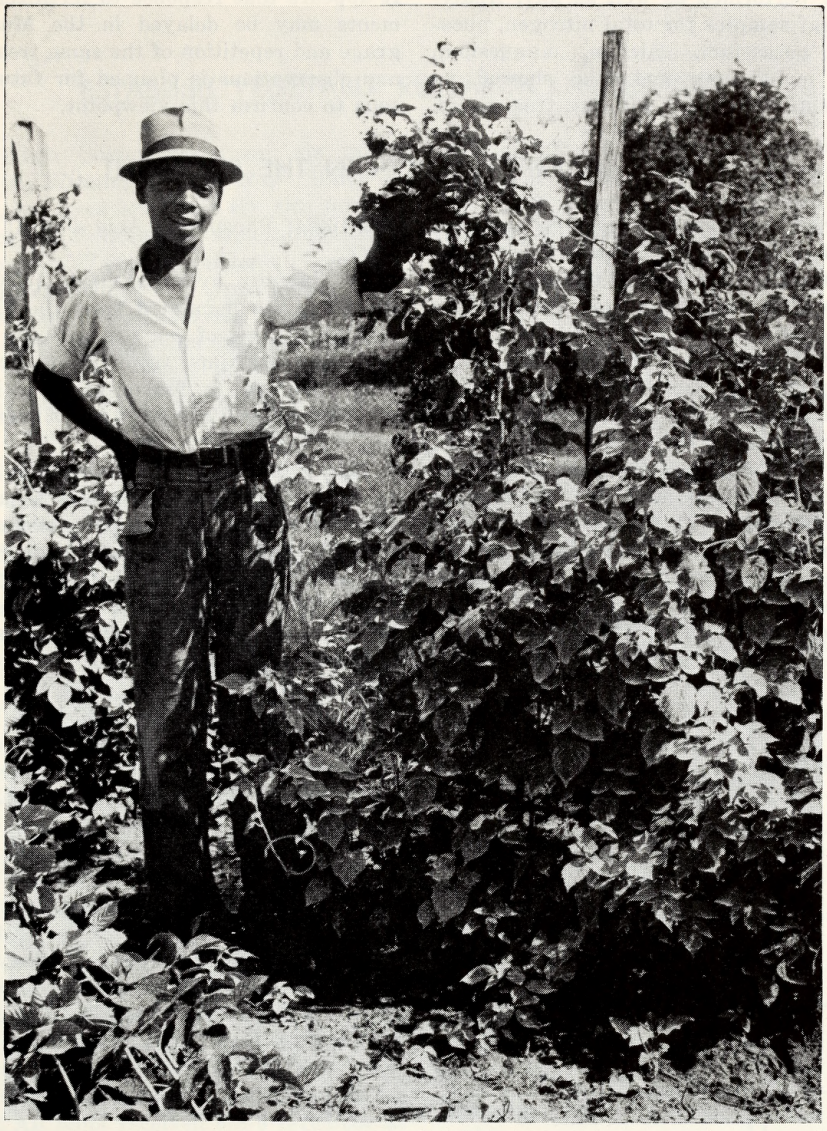


FIG. 50. RASPBERRY PLANTS WERE TRAINED ON STAKES AND CONFINED TO HILLS 5 BY 5. RESPONSE WAS GREATEST ON PLOTS RECEIVING 10 TONS OF MANURE PER ACRE.

parently performed as well as any. Analyses of leaf samples for total nitrogen, phosphorus, potassium, calcium, magnesium, copper, manganese, and zinc showed no significant differences for any treatments. It appears that response to fertilizer treatments may be delayed in the Muscadine grape and repetition of the same treatments and observations is planned for future seasons to confirm this viewpoint.

RASPBERRY FERTILIZATION IN THE PIEDMONT

The results of studies covering a seven-year period at Statesville have yielded some interesting data concerning the nutrient requirements of raspberries in clay soils. The Latham variety was used and plants were confined to hills five feet apart (**Fig. 50**).

Ten plots were included in each of two series of plots and a 4-10-4 mixture used as the basic formula for mixed fertilizer. In addition, stable manure was used at the rate of 10 tons per acre, and at five tons per acre supplemented with 400 pounds of the 4-10-4 mixture. One plot in each series received an annual application of nitrate of soda alone.

Nutrient element differentials covered the following range in pounds per acre: Nitrogen 16-64; Phosphoric Acid 40-128; Potash 16-64.

The highest average yield, 5,086 pints per acre, was harvested from the plots receiving 10 tons of manure and the second highest, 4,863 pints, from the manure-4-10-4 combination. In fourth place with 4,517 pints per acre, was plot No. 8 which received a 4-10-8.

The manure used contained a liberal quantity of litter which served as a mulch and conserved moisture. This accounts, at least in part, for the improvement in yields in the manure, and manure-4-10-4 plots. The role that potash played is not clearly defined but it is indicated that further study is needed.

TRUCK CROPS

ESTABLISH VEGETABLE RESEARCH LABORATORY

The Hugh Oosterwyck farm, six miles north of Wilmington in New Hanover County, has been leased as the site for the new Vegetable Research Laboratory. This tract consists of 50 acres of land, representative of the various soil types in the area, and a number of good service buildings.

The contract has been let for the construction of a laboratory on this property which will consist of office and laboratory space and other necessary facilities. The building will house the resident staff and serve as a base of operations for all research workers who are concerned with problems confronting the truck and bulb growers.

SOIL TREATMENTS FOR ROOT-KNOT CONTROL SHOW PROGRESS

Previous work at the McCullers Branch Station has shown that while Uramon, applied in the spring or fall to soil naturally infested with the root-knot nematode effectively controls root-knot, it often causes a reduction in yields of vegetables in the first crop following treatment. In an effort to reduce this injurious effect, cyanamid or peanut hull meal, or cottonseed meal were applied in addition to Uramon.

Plots were set up in the fall of 1945 on soil heavily infested with the root-knot nematode. All plots, except the checks, were treated with Uramon at the rate of one pound per square yard on October 29. One series received cyanamid at ½ pound per square yard and the Uramon on the same date.

In February, 1946, peanut hull meal and cottonseed meal were added to other plots treated with Uramon four months before (Table 4). All materials were spaded into the upper four to six inches of soil. Marglobe tomatoes were set on all plots on May 8. All plots received 6-8-6 fertilizer at the rate of 1500 pounds per acre before planting. Data on yield and root-knot severity are shown in Table 4. All treatments, excepting Uramon alone and Uramon plus cyanamid, resulted in significant increases in yield over the checks. Uramon plus peanut hull meal and Uramon plus cottonseed meal gave the best yields. All treatments gave good control of root-knot. These data indicate that the addition of cottonseed or peanut hull meal to Uramon-

TABLE 4. EFFECT OF THE ADDITION OF CERTAIN MATERIALS TO URAMON-TREATED SOIL ON YIELD OF TOMATOES AND ROOT-KNOT INCIDENCE.

Material and Rate per sq. yd. [2]		Root Knot Index [1]	Yield per acre (Tons Marketable Fruit)
Uramon	1 lb.	9	5.22
Uramon plus Cyanamid	1 lb. ½ lb.	12	3.99
Uramon plus Peanut Hull Meal	1 lb. 1 lb.	11	7.69
Uramon plus Peanut Hull Meal	1 lb. 2 lb.	12	5.84
Uramon plus Cottonseed Meal	1 lb. 1 lb.	14	9.11
Check (No treatment)		98	3.12

[1] An index of 0 equals no root knot; 100 equals maximum severity.

[2] Uramon and Cyanamid applied October 29, 1945, and all meal applications made on February 25, 1946.

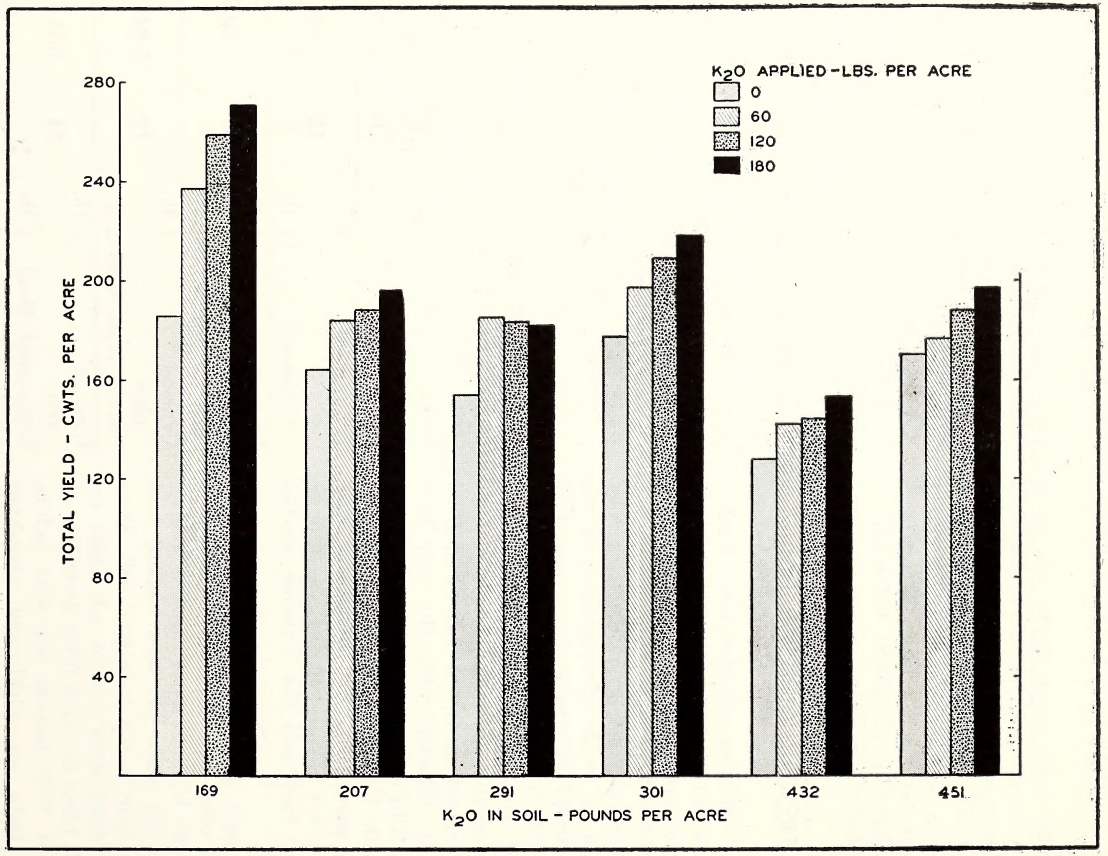


FIG. 51. IRISH POTATOES RESPOND TO POTASH APPLICATIONS UP TO AT LEAST 180 POUNDS OF POTASH (K_2O) PER ACRE (EQUIVALENT TO THE POTASH IN ONE TON OF 6-8-9).

treated soil offers promise for reducing injury to tomatoes in the first crop after treatment.

In another experiment at McCullers, several soil fumigants—chloropicrin, 1-3 dichloropropylene, 1-2 dichloropropane (D-D), ethylene chlorobromide, ethylene dibromide (Dowfume W-10), ethylene dibromide (Iscobrome 4)—were tested for root-knot control. Test crops of tomato, okra, bean and squash were planted on June 15—16 to 20 days after treatment.

Both chloropicrin and D-D mixture caused some stunting of the plants. This was particularly noticeable during the first five to six weeks following emergence. Later such effects largely disappeared except on beans and okra in the chloropicrin-treated plots, which still showed some stunting at maturity. In the chloropicrin-treated plots this toxic effect is thought to have been due, in part at least, to abnormally long retention of the gas in the soil. A heavy rain fell immediately after the chloropicrin was applied and, thus, a partial seal of the soil surface was formed. Some of the chloropicrin probably still remained in the soil at the time of planting, which could account for the stunting effect.

While all treatments gave very good root-knot control, the differences between treatments are not significant, nor were there significant differences in yields between any of the treatments, including the check.

EIGHT IRISH POTATOES IN 500-BUSHEL CLASS

Thirty-nine varieties and selections of Irish potatoes were grown in test plots at Jefferson in 1946 and yields were exceptionally good. Of the total number under test, eight yielded over 500 bushels per acre. Included in the eight high yielding varieties and selections were Sequoia and Sebago, with yields of 588 and 545 bushels per acre, respectively. Sequoia graded out 91 per cent and Sebago 89 per cent No. 1 potatoes.

Among the promising selections in the 500-bushel class were 1362 and 1344 (Beltsville) and 142.9-19 and 142.17-5 (N. C.)

The high yields can be accounted for, in part, by good control of leaf hoppers, flea beetles and late blight with a DDT-Copper combination dust.

DDT GIVES GOOD CONTROL OF POTATO INSECT PESTS

This past season's work has shown that DDT, applied as a 3 or 5 per cent dust, provides an excellent control for the Colorado potato beetle, the potato flea beetle and the tobacco flea beetle. The amount of dust to use per acre as well as the number of applications per season will depend on the abundance of the pests being controlled. In the Raleigh area, two dustings spaced three weeks apart, were enough to control Colorado potato beetle larvae and adults infesting test plots. In the Blue Ridge Mountain area, both the potato flea beetle and the tobacco flea beetle (which also attacks potato foliage) were controlled with seven applications of 3 per cent DDT dust applied at approximately weekly intervals from mid-May to mid-August.

It is possible that DDT applied as a wettable powder spray or water miscible spray may be more economical than the dust forms. Preliminary tests show that the sprays were effective in knockdown of flea beetles but did not have as long residual toxicity to flea beetles as did the 3 per cent DDT dust.

Benzene hexachloride (chemically known as 1, 2, 3, 4, 5, 6 hexachlorocyclohexane) was also used experimentally for potato insect control. This material is effective against Colorado potato beetles and flea beetles but its effects on tuber taste and odor, as well as its soil poisoning, remain to be determined. Consequently, benzene hexachloride is not recommended for potato insect control at this time.

MORE POTASH NEEDED FOR IRISH POTATOES

A good crop of Irish potatoes removes high amounts of potash. In 1947, six experiments with potash applications revealed that the amount of potash in a ton of 6-8-6 fertilizer per acre (120 pounds of potash) was not sufficient for maximum yields of potatoes. An additional 3 per cent potash with a total amount equivalent to that contained in a 6-8-9 fertilizer (180 pounds of potash per acre) increased the average yields seven bags per acre **(Fig. 51).**

The grower who is striving for high yields should supply adequate potash. In some areas the farmers are growing some or all their Irish potatoes under irrigation. They anticipate high yields and these high yields make the necessity for adequate potash still more urgent.

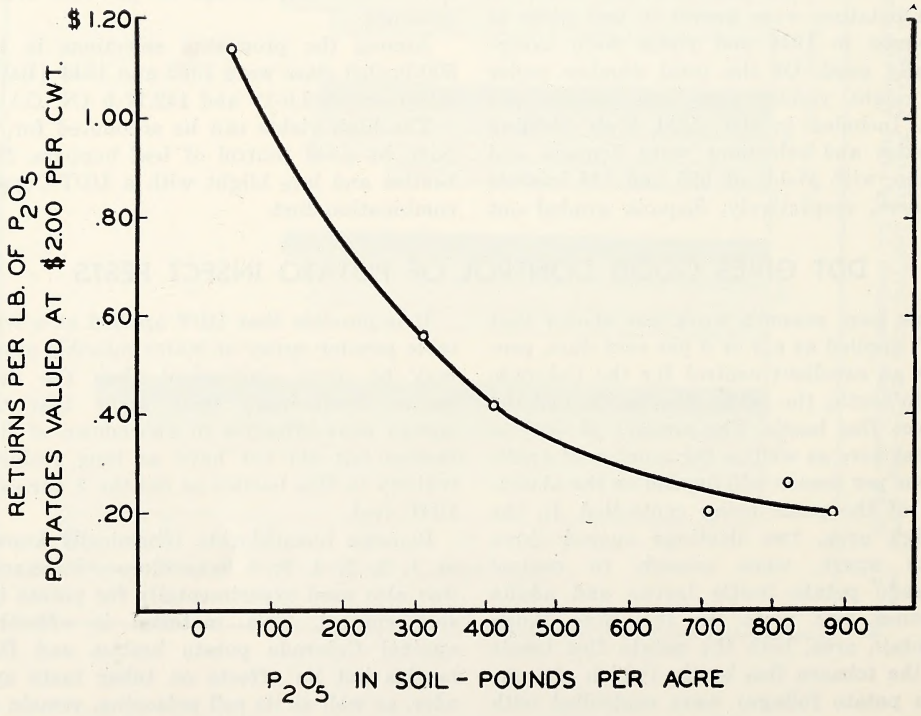


FIG. 52. THE RETURNS PER POUND OF APPLIED PHOSPHORIC ACID DECREASES AS THE AMOUNT OF PHOSPHORUS IN THE SOIL INCREASES (160 POUNDS OF PHOSPHORIC ACID APPLIED).

AS PHOSPHATE IN SOIL ACCUMULATES RETURNS FROM PHOSPHATE FERTILIZER DECREASE

Soil analyses show that the continued application of a ton of fertilizer on the Irish potato soils has caused a high accumulation of phosphate in the soils. This is because a good potato crop removes only 30 pounds of phosphoric acid per acre while a ton of 6-8-6 supplies 160 pounds of phosphoric acid.

Intensive experiments on rates of phosphate applied to Irish potatoes grown on soils with various amounts of soluble phosphate were conducted in 1945 and 1946. The data obtained show that the degree of yield response to applications of phosphate was related to the amount of readily soluble phospate in the soil. The returns from each pound of phospate applied decreases as the amount of phosphorus in the soil increases (Fig. 52). It is interesting, however, that even on the soils containing high amounts of accumulated phosphorus there is a response from applied phosphate.

PHOSPHATE AND POTASH AFFECT SET AND SIZE OF TUBERS

The effects of phosphate and potash applications on number of tubers per hill and size of the tubers were studied. The experiments were conducted on a soil relatively low in both of these nutrients in Washington County.

The data revealed that phosphate is very important in determining the number of tubers set per hill, while potash is important in its effect on the size of the tuber. The first 160 pounds of phosphoric acid doubled the number of tubers set per hill but had little effect on the size of tubers. In contrast, the first 60-pound addition of potash increased the set of tubers per hill only 15 per cent. The size of tubers was increased 30 per cent by additions of potash up to 180 pounds per acre, however.

LIMA BEAN YIELD TRIALS — 1946

Yield tests were conducted at the McCullers Station in 1946 on 10 varieties and strains of lima beans. These were divided equally into two classes: large-seeded bush types for fresh market; and small-seeded bush types for processing. The fresh market types included Burpees Improved Bush, Early Market, Regular Fordhook, Asgrow Fordhook, and Fordhook 242. The commercial processing types were Clark's Bush (Green Seeded Henderson), Henderson, U. S. 243, U. S. 403A, and U. S. 343.

In the large-seeded market group, Early Market gave the highest yield of 22,182 pounds per acre. Asgrow Fordhook was second with 21,756 pounds, and Fordhook 242 was third with 19,320 pounds. The yields of the small-seeded processing varieties were lower. U. S. 242 was highest with 17,904 pounds per acre, Clark's Bush (Green Seeded Henderson) was second with 14,009 pounds, and Henderson was third with 13,718 pounds.

The plots were harvested five times and yields recorded as pounds of fresh marketable pods per acre.

FUNGICIDES CONTROL CUCUMBER DOWNY MILDEW

Dusting experiments conducted at the Willard Test Farm on fresh market cucumbers (A & C variety) and near Delway in Sampson County on pickle cucumbers (National variety) showed that several fungicides were effective against downy mildew *(Peronoplasmopara cubensis)*

The following fungicidal dusts were com-

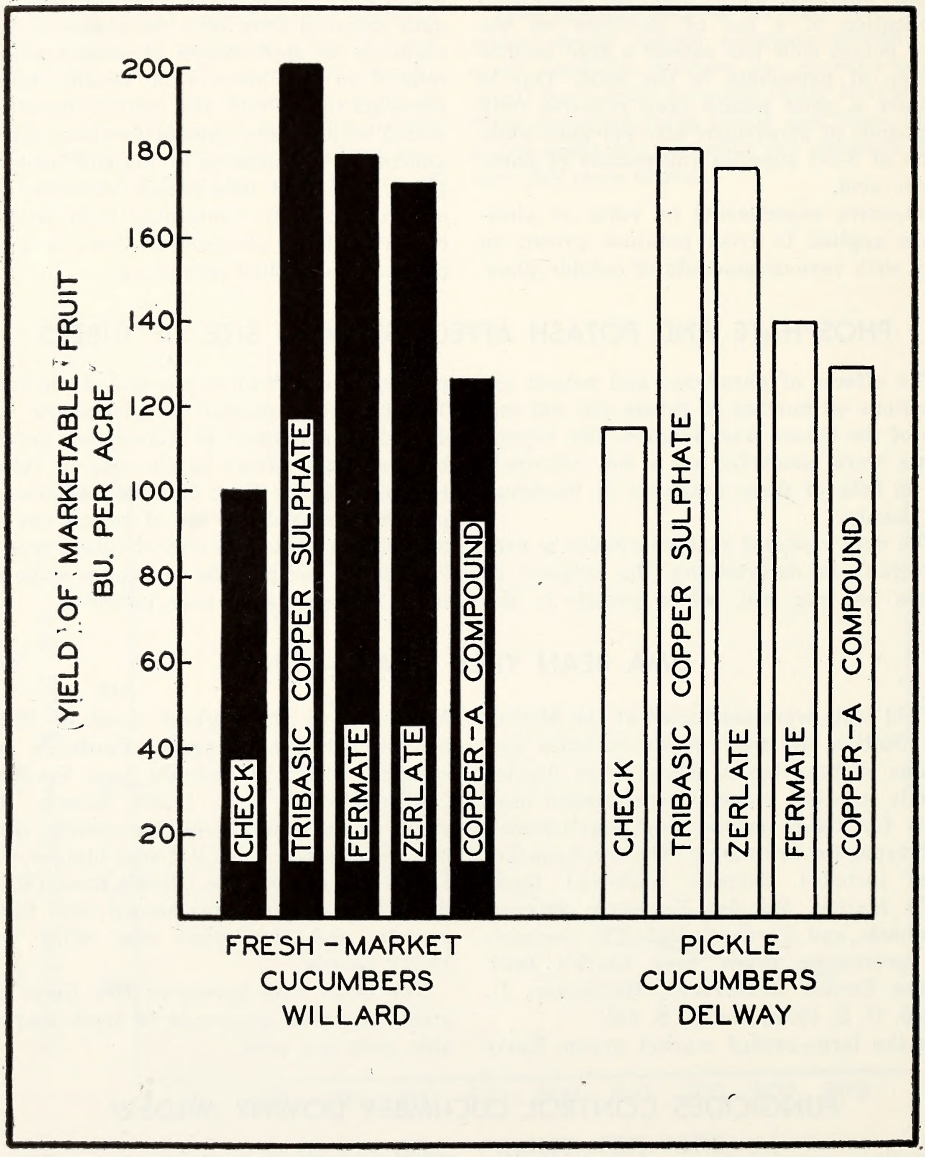


FIG. 53. THE EFFECTS OF FUNGICIDES ON YIELDS OF MARKETABLE CUCUMBERS, 1946.

pared: tri-basic copper sulphate, 5 per cent metallic copper; Copper-A compound (tetra copper calcium oxychloride), 5 per cent metallic copper; Zerlate (zinc dimethyl dithiocarbamate), 10 per cent; and Fermate (ferric dimethyl dithiocarbamate), 10 per cent. Pyrax ABB was the dilutent in all dusts.

The dusts were applied with rotary hand dusters about twice per week from late May through July 5. Ten applications were made at Willard and nine at Delway. The cucumbers were harvested, graded and sold on local markets. None of the dusts materially affected the proportion of fruit in the various grades. Yields of marketable fruit are given in **Figure 53.** At both Willard and Delway the use of tri-basic copper sulphate resulted in the highest yields. At Willard all dusts, excepting Copper-A compound, gave significant increases over the non-dusted check. At Delway, Fermate and Copper-A compound failed to give significant increases over the check. Zerlate showed considerable promise in both tests.

At Willard, not all the increase in yield was due to control of downy mildew because all dusts used gave partial control of fruit infection by the angular leafspot bacterium *(B. lachrymans)*. Data on the last four pickings showed that the percentages of culls due to angular leafspot were less for all treatments than for the check. This disease was of considerable importance throughout the fresh market cucumber area in 1946. It was not of major importance on pickle cucumbers.

On the basis of an average price of $2.20 per bushel paid for fresh market cucumbers in North Carolina in 1946, the increased value of the crop in this test, resulting from dusting with tri-basic copper sulphate, amounted to $220 per acre. Cost of the dust did not exceed $15 to $20 per acre, exclusive of cost of application. Similarly, at an average price for pickle cucumbers of $1.16 per bushel, the increased value due to dusting with tri-basic copper sulphate amounted to $79 per acre.

While these data show that dusting cucumbers for disease control was highly profitable in 1946, it should be pointed out that both downy mildew and angular leafspot were more severe in 1946 than for the past several years. The downy mildew fungus was first observed in North Carolina on May 28. This was several weeks earlier than it usually appears. During June, weather conditions were especially favorable for its spread and development. Hence, while the use of fungicides was highly profitable in 1946, such high returns may not be expected every year.

APPLES AND PEACHES

TEST MATERIALS FOR APPLE INSECTS

DDT has been used by a few apple growers with very satisfactory results against codling moth. However, the infestation of mites last year developed quite rapidly up to harvest time but subsided soon after harvest without the application of any miticides. If growers continue to use DDT on their apples there is a possibility that miticides will be necessary.

One of the most promising new materials for this purpose is hexaethyl tetraphosphate. Limited tests of this material in greenhouses have given fair control of red spider without any injury to the plants. Additional tests are planned for this material during the coming season.

PERFORMANCE OF 'NEW' FUNGICIDES FOR CONTROL OF APPLES DISEASES

Lime-sulfur and Bordeaux mixture, the standard fungicides for control of fruit and foliage diseases of apple for the past four decades, are not without serious shortcomings. Neither is effective against all diseases and both cause considerable injury to the fruit and leaves under some conditions.

In 1946 several materials which might prove to be effective "substitutes" were tested in spray programs (Fig. 54) on apples in Wilkes County. Materials tested included Phygon, Fermate, Puratized Agricultural Spray, Flotation Sulfur (paste) and Experimental Fungicide #341.

Environmental conditions were extremely favorable for the development of apple scab in April, May and June. On unsprayed trees almost 100 per cent of the fruit was scabbed by June 10. The scab epidemic was the most serious one that has occurred in many years. Contributing factors were cool, frequent rain periods and heavy carry-over of the scab fungus in the overwintered leaves from the 1945 season in which scab was able to build up to a high level as a result of favorable weather and the lack of spraying.

Frogeye leafspot developed throughout the season causing most defoliation during June and July. The unsprayed trees were 50 per cent defoliated by mid-July and 90 per cent by mid-September.

Serious spray injury in the forms of russet on fruit and defoliation resulted from the use of the lime-sulfur-Bordeaux program. Slight russett occurred on Phygon- or Fermate-sprayed fruits.

Data on control of frogeye leafspot are summarized in **Figure 54.** For control of frogeye leafspot Phygon and Fermate were most effective. For controlling scab, Phygon and Puratized were most effective. It should be pointed out that these results are for only two diseases as they developed in one orchard. Different results might be obtained under other conditions.

TEST DDT FOR PEACH TREE BORER CONTROL

The work with DDT for the control of the peach tree borer in nursery plantings was continued from the previous year. DDT was used at the rate of four pounds of 50 per cent wettable powder per 100 gallons of water. Trees were sprayed August 1 and checked for borers October 10. At this time the treated block had an average of five infested trees per 100 whereas the untreated block averaged 25-30 infested trees per 100.

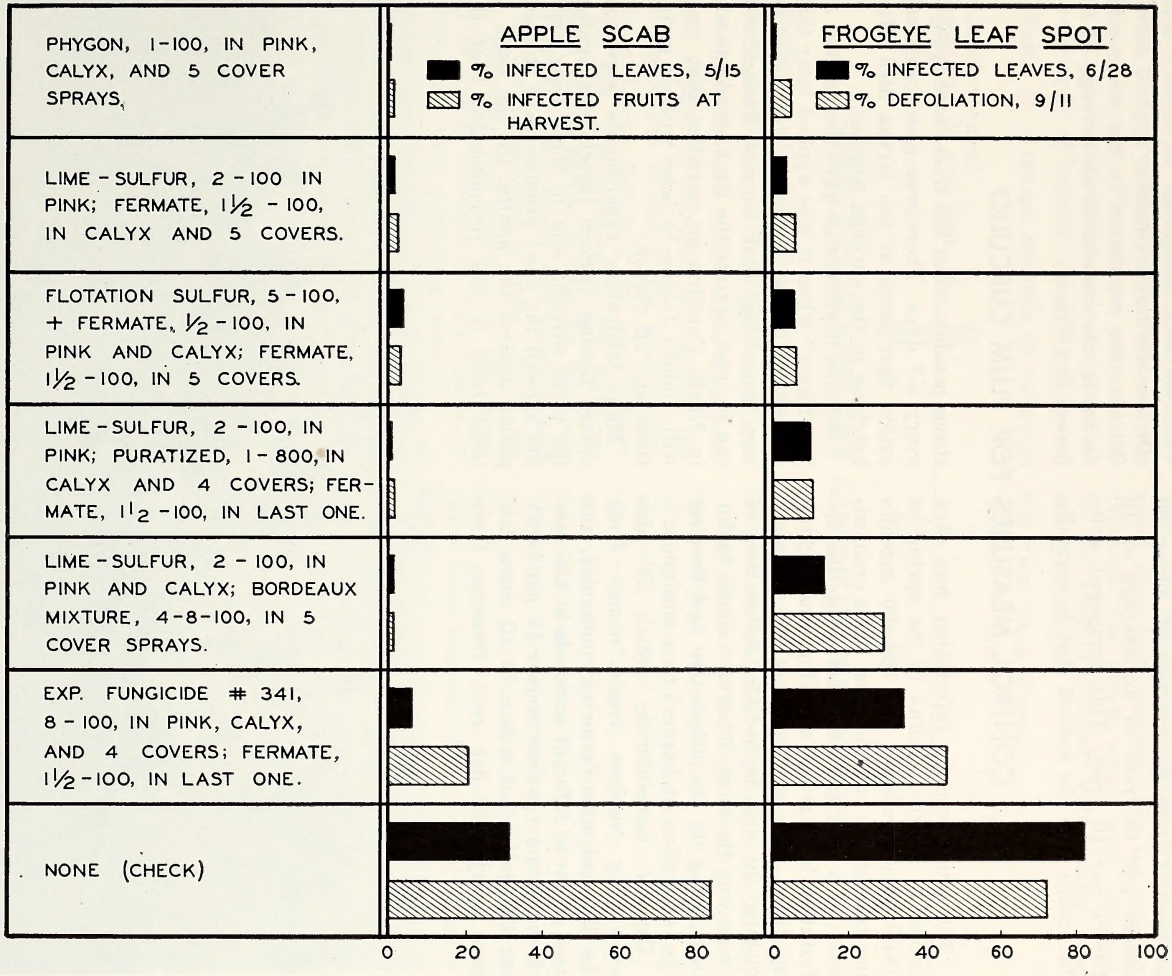


FIG. 54. RELATION OF FUNGICIDAL SPRAY PROGRAMS TO CONTROL OF APPLE SCAB AND FROGEYE LEAF SPOT ON DELICIOUS AND BLACK TWIG APPLE TREES, BOOMER, N. C., 1946.

Results of using DDT in a commercial orchard indicated that DDT reduced the population from an average of 80 or 90 borers per 10 trees to an average of 10 borers per 10 trees. This compared quite favorably with the control that is normally obtained with paradichlorobenzene but it was not nearly as good as control obtained with ethylene dichloride emulsion. With ethylene dichloride emulsion applied during October, the population in the commercial orchards was reduced to an average of 2-3 borers in 10 trees.

CONTROL MEASURES FOR PLUM CURCULIO

The plum curculio infestation was very severe in North Carolina in the spring of 1946—some orchards had 300-400 curculio per tree on the outside rows. Some orchardists did a fair job of cleaning up the infestation by jarring, spraying, and picking up drops. It is believed that the thorough picking up and immediate destruction of drops was the most important single factor in cleaning up the infestation and keeping the infestation at harvest to a minimum.

Benzene hexachloride, which is also known by various trade names from the different manufacturing companies, was used in three different orchards at the rate of one pound (gamma isomer 12 per cent) per 100 gallons of water. In all cases this gave nearly 100 per cent freedom from stung peaches when the trees were sprayed every 3-7 days. There was also some indication that some of the larvae died after hatching in the sprayed peaches.

Benzene hexachloride gave the peaches an "off flavor" when it was applied later than six weeks before harvest. Prospects are very promising that benzene hexachloride can be used against the first brood curculio in North Carolina on varieties that ripen with Golden Jubliee or later without giving them an "off flavor."

Many laboratory experiments were conducted testing various insecticides against the plum curculio and in these tests cryolite showed the most promise as a stomach poison against the adults. On the basis of these tests it was recommended that the

FIG. 55. A SANDHILL'S ORCHARD SHOWING LOSS OF MOST OF THE LEAVES BEFORE MID-SEPTEMBER. THE TREE ON THE RIGHT, WHICH IS STILL HOLDING ITS FOLIAGE, HAD RECEIVED A TOP DRESSING OF NITROGEN IN THE SUMMER.

growers do post-harvest spraying. Records were taken on four orchards on September 24, October 3, 10, and 18. Each of these orchards had more than 50 per cent wormy fruit at harvest. Two of the orchards, #1 and #2, received two post-harvest sprays of four pounds of cryolite per 100 gallons of water. The other two orchards were not sprayed. From Table 5 it will be seen that the unsprayed orchards averaged a great many more curculio than the sprayed orchards. The adults which were collected on the 18th of October were mainly new emerged adults.

TABLE 5. AVERAGE NUMBER OF CURCULIO PER TREE NEAR WOODS.

		9/24	10/3	10/10	10/18
Orchards sprayed About Aug. 20 and Sept. 10	#1	3	..	0	3/5
	#2	6	0	0	3/5
Orchards not sprayed	#3	24	6	6	3
	#4	69	39	39	9

SUMMER NITROGEN FOR SANDHILL'S PEACH TREES

Studies in Sandhills peach orchards of various fertilizers and cultural practices have shown that the maintenance of an adequate supply of nitrogen throughout the growing season is one of the most important conditions necessary for good foliage in the fall. The nitrogen in the fertilizer applied in the spring is used by the trees in forming new growth and peaches, and by harvest time there is little left in the soil. Relieving this shortage by top dressings of soluble nitrogen in July results in greener and more persistent foliage.

Peach trees in certain orchards of the Sandhills may lose more than half their total foliage before the end of August. Such severe defoliation prevents the normal accumulation of food within the trees and decreases winter hardiness. Fruit size is known to be related to the number of leaves. Furthermore, fruit bud formation is much poorer on defoliated trees and, consequently, yields are reduced the following year. Recently more sun scald injury was found to occur on branches of poorly leafed trees.

Experiments with large bearing peach trees showed that the extra nitrogen supplied by a summer application of two and one-half pounds of nitrate of soda was very effective in helping to maintain good foliage (**Fig. 55**). The extra nitrogen had increased foliage retention by 24 per cent. According to counts of leaves made the first of August, the rest of the orchard lost all but 3 per cent of the foliage but the fertilized trees maintained 41 per cent of their leaves.

Young as well as bearing trees benefited from the summer application of nitrogen. Trees that received extra nitrogen in August during each of their first three years have continued to show benefits after the practice was discontinued. The extra nitrogen permitted greater growth during the early years with the result that, in the fourth and fifth years, yields were raised 25 per cent.

SOIL TREATMENTS FOR CONTROL OF ROOT-KNOT OF PEACH EFFECTIVE

Soil treatments for control of root-knot and other soil-borne diseases of the peach were applied to old orchard land in November, 1945, and peach trees were set three months after treatment. Preliminary results (**Fig. 56**) indicated that chloropicrin at 0.13 pound, D-D at 0.08 pound, and Uramon at 1 pound per square yard were quite effective in controlling root-knot of peach in the first year following treatment.

The effect of the treatment upon the growth of trees after treatment is also shown in **Figure 56** in which are presented the average cross-sectional areas of the tree trunks at the end of the first growing season. Trees on the chloropicrin plots and on the D-D plots were much more vigorous and larger than on the untreated plots. However, those on chloropicrin plots were larger than on D-D plots. The trees and seedlings on the Uramon plots were quite stunted. Evidently the toxic residues of the Uramon were still present at the time the trees were planted.

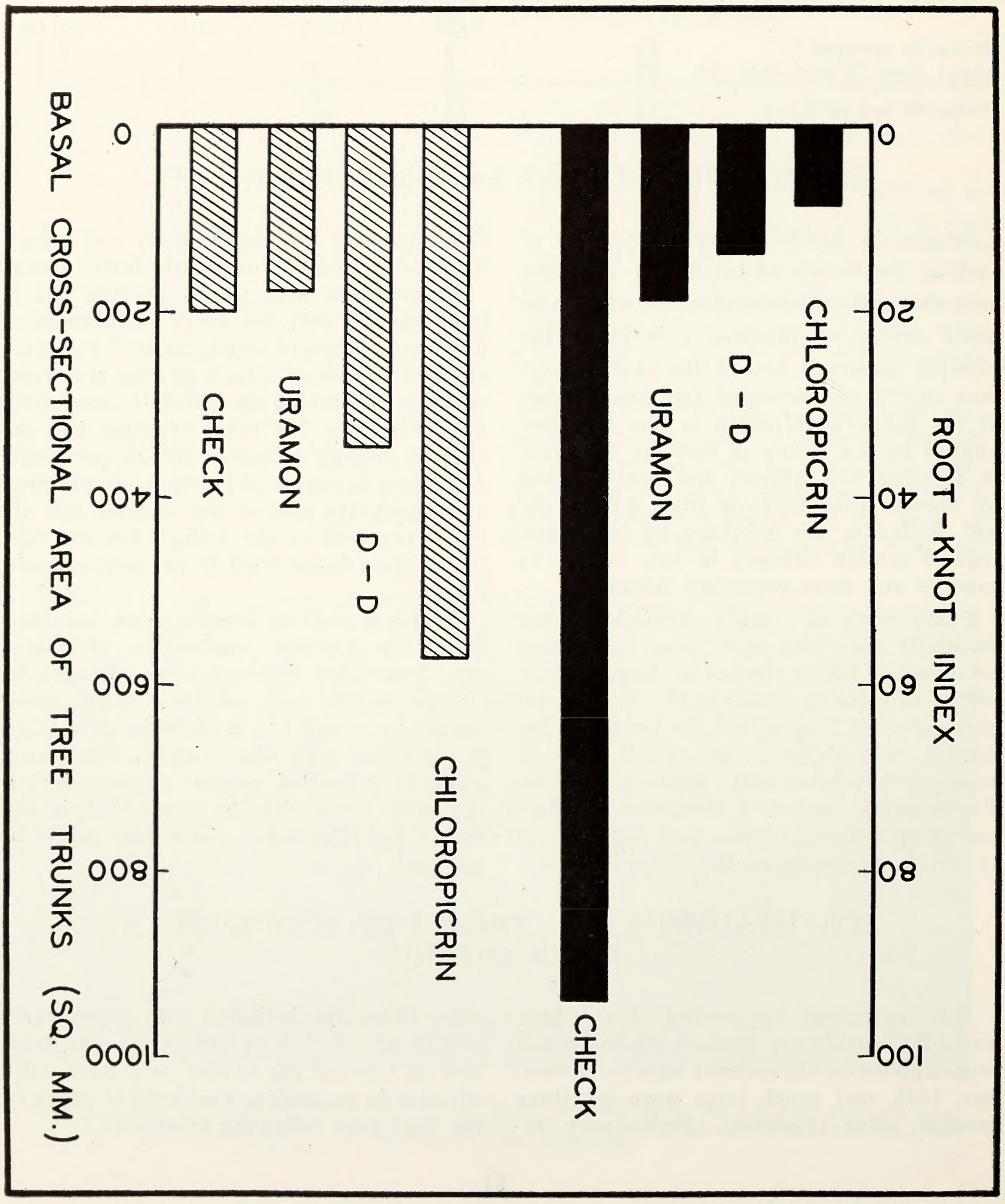


FIG. 56. RELATION OF SOIL TREATMENT TO CONTROL OF ROOT-KNOT AND TO SIZE OF TREES AT THE END OF THE FIRST SEASON.

LIVESTOCK AND POULTRY

BEEF CATTLE, HOGS AND SHEEP

REEDS USEFUL FOR FATTENING BEEF CATTLE

A feeding trial completed in the spring of 1946 with yearling beef steers at the Tidewater Station near Plymouth, showed that reed grazing may well be used in the program to furnish roughage for fattening cattle. The reeds, as shown by the check lot, replaced about 10 pounds of soybean hay per steer daily. For a feeding period of 150 days this would be a saving of 1500 pounds of hay or over 22 tons in finishing a carload of steers.

Twenty-two Hereford yearling steers that were produced at the Station were grazed together on reed areas from May 10 to August 31 and then divided into three uniform groups. Group I (check group) was grazed on reed areas until November 22 and then finished out in the dry lot on shelled corn and low grade soybean hay full fed and cottonseed meal two pounds per head daily. Group II was continued on reeds and fed five pounds of cottonseed meal per head daily and a full feed of ground corn until finished. Group III was handled the same way as Group II until November 22 and then fattened in the dry lot in the same manner as Group I.

The steers made an average daily gain of three-quarters of a pound per head for the grazing period from May 10 to August 31. Following the division on August 31, for the period to November 22, Group I (unsupplemented) made an average daily gain per head of only 0.33 pound, while Groups II and III combined (supplemented) gained 1.40 pounds. After going into the feed lot on November 22 Group I made an average daily gain of 2.05 pounds until finished on March 15. For this same period Group II (on reeds and concentrates) made an average daily gain of 1.36. From November 22 until finished on February 15 Group III made an average daily gain of 1.92 pounds. The concentrates consumed per hundredweight gain were 733 pounds, 927 pounds, and 832 pounds for Groups I, II, and III, respectively. Each group was fed to an average grade of low choice before it was sold, but Group I was not carrying quite as much finish as the other groups.

The trial indicates that good reed pasture can well be used in either partially or completely finishing cattle for market. Gains on reeds alone after August are very poor but can be greatly increased by the addition of concentrates. The system followed in Group II of finishing on reeds by the addition of concentrates after mid season, saved about 10 pounds of hay per head daily, and the system in Group III of partially finishing on reeds as in Group II and then moving to the dry lot in November for the remainder of the finishing period, shortened the feeding period about one month **(Fig. 57).**

HONEYSUCKLE OF VALUE IN FOREST PASTURES

Cattle in Piedmont forest pastures will eat honeysuckle in large amounts where it is plentiful. This was demonstrated in observations made by the Division of Forestry on the grazing habits of steers in several forest pastures at State College.

The two 30-acre pastures in which the observations were made differed greatly in acreage and quality of honeysuckle. In pasture I over six of the the seven acres of honeysuckle were on high land. The estimated average production by the end of the eight-week grazing season for this high land was 500 pounds, air-dry, per acre. In pasture II there were 11 acres of honeysuckle, nearly two acres of which were in an open bottomland area producing an estimated 4,500 pounds per acre (**Fig. 58**). The remaining nine acres produced about 900 pounds per acre by the end of the grazing season.

Honeysuckle made up over 80 per cent of the diet of the yearling steers in pasture II for the entire season. The supply of grasses and herbs was not abundant but small trees in the sizes readily browsed by the cattle were plentiful. Nevertheless, the steers consistently obtained the bulk of their diet from honeysuckle, especially in open or only slightly shaded bottomland areas. In pasture I the honeysuckle areas were heavily grazed but the supply was insufficient to meet the demands of the steers. During the first several weeks of the grazing season the amount of tree browse taken in pasture I was rather small, but during the closing weeks, after other forage became limited, tree browse made up over half of the diet. During the 56 days of the test the steers in pasture II gained an average of 60 pounds or 1.07 pounds per day. In pasture I the steers became ill during the second week of the test. This resulted in a high weight loss which upset the cattle gains for the season.

Chemical analysis of honeysuckle collected while observing the grazing habits of the steers showed that material from open bottomland areas had an average crude protein content of 11.1 per cent, 0.92 per cent calcium, and 0.30 per cent phosphorus. For material from uplands these percentages were only 8.0, 0.68, and 0.25, respectively.

FIG. 57. GOOD REEDS LIKE THESE CAN NOT ONLY BE USED FOR SUMMER OR WINTER GRAZING BUT WILL ALSO FURNISH THE ROUGHAGE FOR THE FATTENING PERIOD.

TASTE OF BEEF UNAFFECTED BY ULTRAVIOLET AGING

Beef carcasses aged 7 and 14 days at 38° F. under ultraviolet lights were found to be equally desirable by a tasting committee as beef aged without ultraviolet lights. A total of 12 beef carcasses were used in an aging experiment to determine whether prolonged aging and aging under ultraviolet lights produced undesirable fat flavor. The left sides of the carcasses were aged with lights and the right sides without lights. Chemical and taste tests showed that all the beef was in excellent condition after being stored six months at zero degrees. While all the beef was acceptable from a taste standpoint, chemical test showed that there was greater chemical breakdown in the beef aged under the lights.

FIND NO RANCIDITY IN FRESH FROZEN PORK

Back fat samples from pork carcasses aged 2, 4, 6 and 8-day periods were frozen and defrosted four times during a nine months storage at zero degrees **(Figs. 59 and 60).** Chemical tests indicated that the peroxides and free fatty acids were very low. Taste tests also indicated no rancidity or free fatty acid formation. Free fatty acid

FIG. 58. YEARLING STEERS IN A HEAVY GROWTH OF HONEYSUCKLE. AS MUCH AS 80 PER CENT OF THE DIET OF THESE STEERS WAS HONEYSUCKLE. NOTE THE DEFINITE HEIGHT LINE ABOVE WHICH CATTLE CANNOT REACH ON THE CLUMPS OF VINES DROOPED OVER TREES.

FIG. 59. A PART OF THE NEWLY MODERNIZED MEAT LABORATORIES. SHOWN ARE THE HOLDING AND SLAUGHTER ROOMS WHERE EXPERIMENTAL ANIMALS ARE DRESSED TO SECURE INFORMATION ON THE VALUE OF THE CARCASSES AS WELL AS OTHER IMPORTANT DATA.

FIG. 60. A SECTION OF THE NEW LOW TEMPERATURE STORAGE ROOM. HERE INFORMATION IS SECURED AS TO THE BEST METHODS OF PREPARING MEATS FOR FROZEN STORAGE. INFORMATION IS BEING SECURED ON THE BEST METHODS OF CUTTING, PACKAGING, FREEZING, AS WELL AS OTHER PRACTICES WHICH AFFECT THE QUALITY AND NUTRITIVE VALUE OF THE FROZEN PRODUCT.

and peroxide values were significantly higher after nine months storage than after four months.

Pork fat is ordinarily considered to be very susceptible to rancidity development. For this reason, authorities recommend that pork carcasses be cut up and frozen within 48 hours after slaughter and that the frozen pork be stored not longer than six months. The fact that fat samples studied were non-rancid after eight days aging, repeated thawing and freezing, and after having been stored for nine months at zero degrees emphasizes marked differences that exist between fats of different pork carcasses. Work is needed to provide information on the relationship of feeding practices and hereditary variations to fat composition.

SHORTER AGING OF PORK UNDER ULTRAVIOLET LIGHTS BETTER

Ultraviolet lights are used by many locker plants in the aging room to assist in controlling molds and other microbial growth. Certain authorities, however, point out that light in the ultraviolet range has an effect in stimulating rancidity development. Experiments conducted during the past year show that with pork carcasses studied, the aging of pork for seven days under ultraviolet lights did not produce rancid pork after 9½ months of storage at zero degrees. Chemical tests showed, however, that there was significantly more breakdown after seven days of aging than after two days. These differences were not sufficiently great to show up with taste tests.

SHEEP YIELD HIGH RETURNS FOR PIEDMONT FARMS

Few sections of the United States enjoy the natural advantages of Piedmont North Carolina for sheep raising (**Fig. 61**). A mild climate, a long growing season, and a soil well adapted to the growing of small grain crops for winter pasturage, are some of the unique advantages enjoyed by this section. Experiments conducted over a five-year period at the Piedmont Experiment Station indicated that either barley or rye

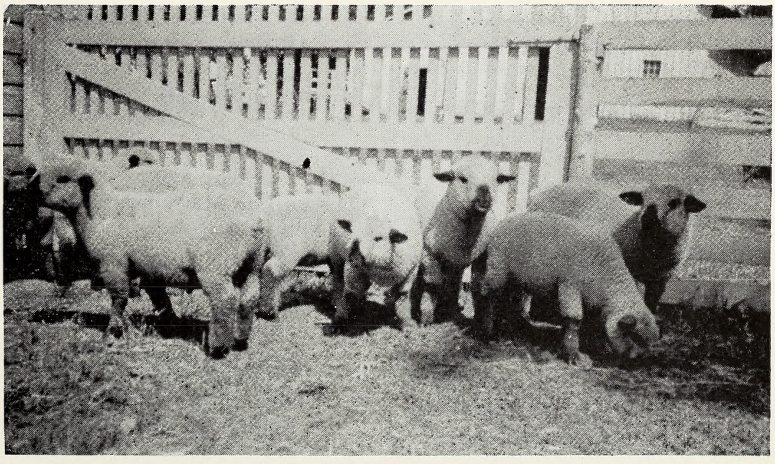


FIG. 61. WELL-GROWN THRIFTY LAMBS THAT PROFITABLY SUPPLEMENT THE FARM INCOME.

would usually afford good pasture during the period November 1 to April 1 with the exception of most of December and January. It was also found that by providing alternate pastures and varying seeding dates, a combination of rye or barley with lespedeza could be grazed throughout the year, using a temporary grazing system entirely.

The mild climate makes it possible and worthwhile to raise early lambs which are ready for market by May 20, enabling the producer to sell on the early market before the bulk of the spring lambs are ready and when prices are usually highest. Also, these early lambs can be marketed before hot weather and the resulting difficulties from internal parasites.

COMPARING SYSTEMS OF BREEDING FOR MARKET LAMB PRODUCTION

Although Western North Carolina has always been the most important sheep producing area of the state, sheep numbers have steadily declined during the past 15 years. Increased carrying capacity of pastures, plus favorable lamb and wool prices, are now serving to renew interest in sheep production. However, at the present time, satisfactory replacement ewes are not available locally in sufficient numbers to supply the demand. Therefore, studies were begun at the Upper Mountain Experiment Station in 1945 to compare the efficiency of the following systems of breeding and ewe replacement for the production of market lambs.

- Mating purebred Hampshire rams to native Hampshire ewes and making ewe replacements from ewe lambs raised.
- Mating purebred Hampshire rams to Western cross-bred ewes and buying replacements.
- Crossbreeding using native Hampshire ewes and sires from four mutton breeds in rotation, replacements to be made from ewe lambs raised.

Information to be obtained from this project relative to the advantages of crossbreeding and the profitableness of buying ewe replacements compared to raising them is of the utmost importance to the sheep producers of Western North Carolina.

DAIRYING

GELATIN STABILIZER GIVES BEST QUALITY ICE CREAM

A stabilizer is used as an ingredient in the manufacture of ice cream to give desirable flavor, body and texture, and melting characteristics to the finished product.

The basic stabilizing materials used in the ice cream industry, including gelatin, sodium alginate, cellulose gum, cereal gum, carob bean gum, gum Arabic, lecithin and mono and di-glycerides, have been compared in ice cream frozen on both the batch and continuous freezers. The basic stabilizing materials were supplied by 16 commercial products.

Determinations were made of the effect of various stabilizers on the properties of the mix and the flavor, body and texture, and melting properties of the finished ice cream. Some variation in flavor and body and texture characteristics was found in the ice cream when different stabilizers were used. The kind of stabilizer used caused considerable variation in the melting properties of the ice cream.

In comparison to other stabilizing materials studied, results show that high Bloom strength gelatin or products containing gelatin produced a finished ice cream with the most desirable characteristics.

CURD STRENGTH OF MILK VARIES WITH SEASON AND BREED

Studies have been made concerning the curd tension value of milk produced by the Ayshire, Jersey, Guernsey, and Holstein breeds of cattle. A total of 365 curd tension determinations were made over a period of five months during the spring and summer seasons. These determinations included milk produced by 107 different animals.

The results show that the milk had a higher curd tension value in spring than in summer and that the Jersey and Guernsey breeds produced milk with a higher curd tension value than did the Ayshire and Holstein breeds. The average curd tension value of the milk for each month during the study was as follows: April 58.5 grams, May 45.8 gm., June 46.2 gm., July 37.3 gm., and August 35.3 gm. The average value for the different breeds was as follows: Jersey 59.4 grams, Guernsey 44.8 gm., Ayshire 39.1 gm., and Holstein 32.7 gm.

HEAVY FERTILIZATION DOES NOT LIMIT PARASITIC LARVAE

An increasing livestock population and an added emphasis on pastures increases the importance of control of internal parasites, as this is largely a pasture problem. The number of parasitic larvae per unit of pasture area is a large factor in the success or failure of the younger animals on pasture.

In this study, three series of six greenhouse plots each were fertilized with lime, phosphoric acid, potash and nitrogen in different combinations.

Each plot was also fertilized with manure at the rate of eight tons per acre. This manure contained about 250 eggs per gram.

The plots were left in the greenhouse until the first of June. At that time, they were removed to the regular pasture area.

The first two years' data indicate that:

- The fertilizer treatments used do not give a significant variation in larval counts.
- The hay making process appears to destroy the larvae.
- The silage making process also appears to destroy parasitic larvae.

SORGHUM SILAGE INADEQUATE AS ROUGHAGE FOR DAIRY HEIFERS

Dairy heifers failed to make good growth on sorghum silage with limited protein supplements. The eight heifers used were allowed all the sorghum silage they would eat. In addition, one group was fed two pounds of cottonseed meal per day, and the other group received one pound of cottonseed meal and five pounds of lespedeza hay per day. The heifers used in this study were 12 to 15 months old. The feeding periods were 100 days in length.

Both groups of heifers failed to make satisfactory growth.

They were placed on good pasture and made a fair recovery. Sorghum silage is not as efficient as corn silage, and when it is used, it should be supplemented with larger amounts of hay or concentrates.

MASTITIS CAN BE CONTROLLED

Good care and management, coupled with good sanitation, are the first essentials in mastitis control. Treatments, alone, are of little permanent value, but when supported by good care, management and sanitation, if applied wisely, they are an effective weapon in reducing infection, and lengthening the production period of the individual.

In a study of six herds, four of which practiced good sanitation and managed milking, the above results were borne out. In the beginning, the cases that were in the advanced stages of the disease were removed. This is one of the essentials of good sanitation.

In the four herds there is but little mi-

FIG. 62. A FALL SEEDING OF LADINO CLOVER AND ORCHARD GRASS MAKES EXCELLENT GRAZING FOR DAIRY CATTLE THE FOLLOWING SPRING.
THE MIXTURE WAS PLANTED IN SEPTEMBER, AT THE RATE OF 4 POUNDS OF LADINO CLOVER AND 15 POUNDS OF ORCHARD GRASS PER ACRE. PICTURE TAKEN AT THE PIEDMONT DAIRY RESEARCH FARM.

croscopic evidence of mastitis infection, and there has been but little clinical evidence for over a year. A number of cases of mild infection have subsided, and later tests have not shown evidence of infection. Good management to build up resistance and sanitation to reduce the chances of and the amount of infection, will give an opportunity for self repair.

Penicillin treatments have been used on 15 quarters infected with Streptococci Agalactiae (bacteria causing mastitis) with good results. Treatment during the heavy lactation period often gives results of a temporary nature, and it is necessary to retreat near the end of the lactation period to obtain permanent repair.

FIG. 63. BARLEY AND CRIMSON CLOVER ARE EXCELLENT CROPS FOR LATE FALL AND EARLY SPRING GRAZING. LIKE MOST TEMPORARY GRAZING, THE COST OF NUTRIENTS IS HIGH, BUT WITH THE NEEDED STIMULUS FOR MILK PRODUCTION AT THIS TIME OF YEAR, THE PROTECTION OF PERMANENT PASTURES, AND THE CONTROL OF SOIL EROSION, THE ADDITIONAL COST IS JUSTIFIED.

POULTRY

LESS MORTALITY AND BETTER EGG PRODUCTION IN TURKEYS

Breeding of turkeys is aimed toward improving the shape and appearance of dressed birds, toward lowering the cost of poults by having better rate of laying, hatchability of eggs, and less broodiness, and toward decreasing the mortality of both growing and breeding stock. Turkeys reared in 1946 showed some improvement over those of the previous two years in most objectives, but not in all.

In 1946, mortality was 13.4 per cent to time of confining young hens to laying house, and 3.8 per cent in the laying house. In 1945, the percentages were 17.4 and 9.8, respectively. The percentage of total days in production lost by broodiness was 8.2 in 1946, and 11.2 in 1945. The percentage of total days on which eggs were laid for the first eight weeks of production was 77.7 in 1946, 73.7 in 1945. No change was noticeable in body weights, conformation, and sexual maturity.

As in previous years, all superior young toms were distributed among breeders of turkeys in the state.

INBREEDING STUDIES AT THE MOUNTAIN STATION

These studies involve the inbreeding of broiler lines. Four single mated pens of Barred Plymouth Rocks and four of New Hampshires were established in the fall of 1945. In the birds selected for these matings, family hatchability and the factors affecting broiler quality such as feathering, growth, and body conformation were stressed. Comparative results show that the feathering was more consistent in all birds in 1946 than in 1945. Body weight at 12 weeks was better in 1946 than in 1945 for all strains studied, this improvement ranging from three to six ounces. The body weights of pullets raised were approximately the same for 1946 as for 1945. The inbred lines to date have not been developed to the extent that they are ready for application.

PARATYPHOID TRANSMITTED BY MANY MEANS

In some flocks of chickens and turkeys there are what are known as carriers of disease. These birds do not usually show outward signs of the disease, but may transmit infection through the breath, the feces, in the egg or on the shell of the egg. To test the part that shell infection may play in transmitting paratyphoids in chickens and turkeys, shell and egg content of eggs from carrier birds were tested for infection. These tests showed that both the shell and egg content were infected in a small percentage of cases.

As it is believed that infection may be carried through the feces of carrier birds, tests were made of feces of such birds and these proved positive for a period of several weeks.

The possibility of germs being deposited in the drinking water by birds infected with paratyphoid was tested and it was found that not only were such germs deposited in the drinking water, but these organism would live and actually multiply in the water. The rinsing of water containers failed to remove the infection, but scalding the containers each day was a very effective method of killing the germs.

Other tests showed that paratyphoid germs put on the shell of turkey eggs actually penetrated through the shells of such eggs into the egg content, and the albumin of the egg had little destructive effect on the germs.

These studies show that where paratyphoid infection exists in turkeys or chickens, careful blood testing should be done to remove the carrier birds.

SANITATION IMPORTANT IN CONTROLLING FOWL TYPHOID

Fowl typhoid is one of the serious diseases of chickens in North Carolina. While it usually affects small flocks of chickens where management is poor, it may also affect commercial flocks where more ideal management is practiced. Past work by the Station proved that in the majority of outbreaks, vaccination, together with careful sanitation and careful culling, checked the outbreaks of typhoid. The relatively recent discovery of the value of sulpha-drugs in combatting human and livestock diseases indicated that these should be tried in control of fowl typhoid. On this basis such trials were conducted on field outbreaks of this disease with the following results.

Sodium sulfathiozole used in the drinking water along with poor sanitation and management controlled mortality only for the period of medication. The same results under similar conditions were secured when this drug was used in an outbreak of pullorum disease in young chicks. Tests were made with sulphamethazine used in the mash and results indicate that this method holds some promise, for the drug can be used for some weeks without apparent harm to the birds. In all the trials conducted to date, the necessity of good sanitation is apparent, regardless of the treatment used.

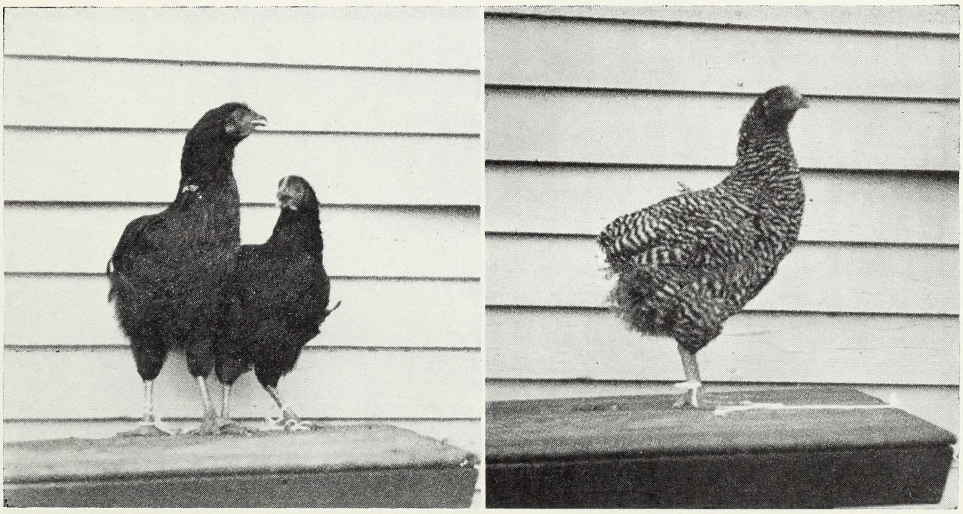


FIG. 64. INBREEDING IS A BREEDING METHOD THAT IS USED TO FIX DESIRABLE CHARACTERISTICS AND ELIMINATE THE UNDESIRABLE. INBRED LINES OF NEW HAMPSHIRES, RHODE ISLAND REDS, AND BARRED PLYMOUTH ROCKS ARE UNDER DEVELOPMENT BY THE EXPERIMENT STATION. THESE LINES ARE SELECTED ON A FAMILY BASIS FOR EGG AND BROILER QUALITIES. PICTURED ABOVE ARE RHODE ISLAND REDS AND BARRED PLYMOUTH ROCKS AT BROILER AGE. AFTER THE LINES ARE ESTABLISHED, VARIOUS CROSSES WILL BE MADE BETWEEN BREEDS AND INBRED LINES OF THE SAME BREED TO STUDY THE ECONOMIC VALUE OF HYBRIDS TO THE FARMER.

RELEASING BREEDING STOCK OF BETTER RHODE ISLAND REDS

Breeding work for superior utility Rhode Island Reds is being conducted at the Willard Test Farm. This work is based on family performance in which all inherited factors of commercial importance are stressed. Special emphasis is being laid on early feathering so that this valuable factor will be highly developed. Hatchability of fertile eggs in 1946 was 90 per cent and egg production in 1945 was improved over that in 1944 on a six months basis. Livability in these studies was exceptionally high. Some breeding stock from the better families is being released into the section in cooperation with the newly developed Pender County Poultry Project.

DEVELOPING SUPERIOR INBRED LINES OF POULTRY

Fundamental work is being done at the College Poultry Plant toward the development and comparison of hybrids and purebreds considering the economics of each from the standpoint of the farmer. Rhode Island Reds and Barred Plymouth Rocks

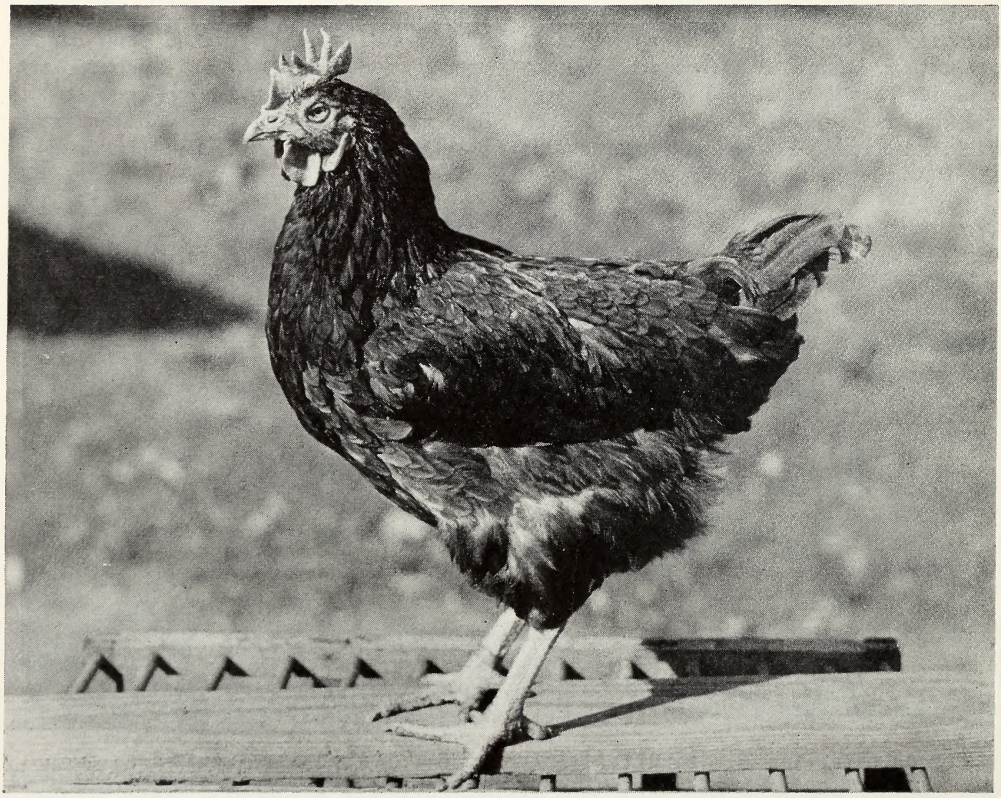


FIG. 65. THE DEVELOPING OF SUPERIOR LAYERS IN CHICKENS REQUIRES MANY GENERATIONS OF MEASURING THE "LAY ABILITY" OF THE GERM PLASM ON THE BASIS OF THE PRODUCTION OF THE FAMILY RATHER THAN THE INDIVIDUAL HEN. THIS RHODE ISLAND RED LAID 333 EGGS IN 365 DAYS.

are being used in these studies. Approximately 1500 pedigreed chicks were hatched in 1946 and over 400 pullets placed on family test. From these, three pens of genetically similar females were mated to closely related males and one pen of each breed was mated to a male not closely related. Results of the above matings indicate that broodiness in both the Rhode Island Reds and Barred Plymouth Rocks has been primarily eliminated by selection on a family basis; sexual maturity is about 195 days for the Barred Plymouth Rocks and 215 days for the Rhode Island Reds. Egg size for both breeds computed from samples taken in November is about 53 grams. The work completed to date is that of establishing the foundation for future study.

ABILITY TO LIVE IS INHERITED BY POULTRY

Two Single Comb White Leghorn strains obtained from private breeders were mated to North Carolina State cockerels and cockerels from the original strains. Approximately 200 pullets from these matings were housed in the fall along with about 150 White Leghorns coming from the North Carolina strain matings. These pullets were housed and were measured for egg production factors and for livability. The following results were secured in this test.

During the fall of 1945 and the spring of 1946, the mortality in the North Carolina State strain of pullets was around 7 per cent, whereas the mortality in the strains from the two private breeders was 27 and 48 per cent, respectively. Egg size computed from weights taken in the fall months was better in the progeny from the private strains than in the private strains mated to North Carolina State males. Egg production, however, appeared better in the strain crosses.

CROSSBRED YEARLING HENS LAY BETTER THAN PUREBREDS

Sixty-two yearling hens, approximately one-half purebred birds and one-half crossbreds, were kept for a second laying year. To measure persistency of lay, no bird was removed from the test until she went into a complete molt.

In this test the crossbreds averaged about 30 more eggs per bird than the purebreds.

NUTRITION

SWEET POTATOES ARE GOOD SOURCE OF VITAMINS A AND C

The importance of the sweet potato as a source of vitamin A (carotene) and vitamin C (ascorbic acid) has not been emphasized as much as it should be. It is not generally realized, for example, that the yam has a vitamin A value from one to two times as great as that of the best summer butter, nor that as a source of vitamin C it is half as good as fresh orange juice or lemon juice and equal to that of tomato juice.

During the past two years, experiments have been carried out on the vitamin A and vitamin C content of nine varieties of sweet potatoes. The varieties studied included Little Stem Jersey, Maryland Golden, Nancy Gold, Ranger, Unit 1 Porto Rico, L-132, B-2934, B-703, and L-37.

For both years, Ranger, Maryland Golden, L-37, and Nancy Gold had the highest carotene values, while Little Stem Jersey and B-2934 had low carotene values.

At harvest, Maryland Golden and Nancy Gold had the highest vitamin C content, while the remaining varieties contained lower, fairly equal amounts. The loss of vitamin C was not significant during curing for seven days at 85° F. and at a relative humidity of 75-85 per cent.

Thus, the sweet potato, primarily an energy food low in fiber and highly digestible, can furnish in one average serving two-thirds of the adult daily allowance of both vitamin A and vitamin C.

COOKING METHOD USED INFLUENCES VITAMIN C IN COLLARDS

It is essential that the housewife know the best cooking methods, methods that conserve the most food value. Otherwise, a good source of nutrients may become a poor source after cooking.

To determine the effect of cooking on vitamin C in collards, studies were made on four varieties, Herring, Morris, Vates, and Wonder. The raw collards contain an average of 116 mg. per 100 grams. When cooked in a pressure saucepan for five minutes, the average retention obtained immediately after cooking for all varieties was 66 per cent—7 per cent was dissolved in the cooking liquid and 27 per cent destroyed. When boiled in a covered pan for one-half hour, the average retention for all varieties was 21 per cent—56 per cent was dissolved in the cooking liquid and 23 per cent destroyed **(Fig. 66)**.

Differences in retention, solution, and destruction between varieties were very small. When the freshly-cooked material was allowed to stand for 20 minutes at room temperature, corresponding to holding before or during meals, there was no further loss in vitamin C, regardless of the variety or the method of cooking.

Thus, collards when properly cooked are an excellent source of vitamin C, containing about twice as much vitamin C as orange juice. Boiled collards are a fair source of vitamin C.

IMPROVED METHODS FOR ESTIMATING GOSSYPOL IN COTTONSEED AND COTTONSEED PRODUCTS

Cottonseed products are of considerable economic value in the Southern states, furnishing a greatly needed supply of protein feed and large amounts of high quality vegetable oil which is used for salad oils and shortening. Cottonseed contains a substance,

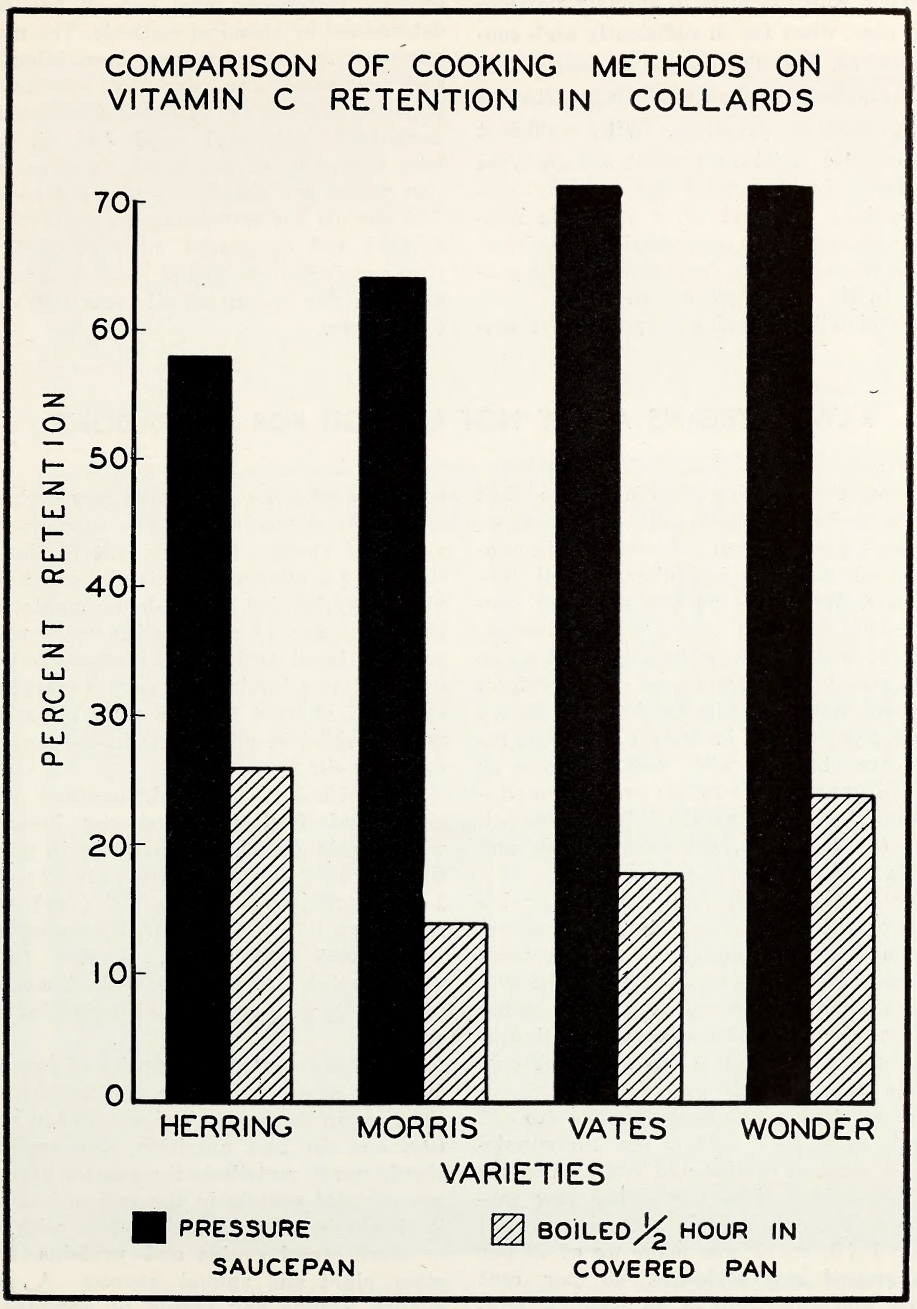

COMPARISON OF COOKING METHODS ON VITAMIN C RETENTION IN COLLARDS
PERCENT RETENTION
70
60
50
40
30
20
10
0
HERRING
MORRIS
VATES
WONDER
VARIETIES
PRESSURE SAUCEPAN
BOILED 1/2 HOUR IN COVERED PAN

FIG. 66.

gossypol, which is toxic to animals, particularly pigs, when fed in sufficiently high concentrations. The distribution of gossypol in the manufactured products are related to the processing practices. With sufficient cooking and moisture content the gossypol remaining in the cottonseed meal is converted into an inert form which is nontoxic. Changing manufacturing processes makes necessary the evaluation of the gossypol in the manufactured products.

The distribution of gossypol in the cottonseed, cottonseed meal and oil has been determined by chemical methods. The methods used in the past have been laborious and time-consuming. Recently, spectrophotometric methods for estimating gossypol in cottonseed, cottonseed meal and oil have been developed at the North Carolina Station which are simple, precise and speedy. The method for estimating gossypol in cottonseed and cottonseed meal reduced the time required from 48-120 hours to 2 hours, and that for cottonseed oil from 120 hours to 2 hours.

RAW SOYBEANS ALONE NOT ENOUGH FOR PIG RATIONS

Among the proteins of plant origin, that of raw soybeans is generally considered of excellent quality when fed correctly in supplemental mixtures including animal by-products. When fed as the principal protein supplement to young pigs, however, ray soybeans do not produce as rapid gains as do protein supplements of animal origin. Previous work at this Station has shown that for young pigs in dry lot very poor results are obtained with raw soybeans as the main part of the ration even when supplemented with a mineral mixture, some fish meal (or tankage), cottonseed meal, and alfalfa leaf meal.

The present study was undertaken because of repeated failures to find practical protein feeds or methods of feeding them that would supplement adequately the diet of pigs gleaning harvested fields and eating a large proportion of raw soybeans. Similar failures had resulted in dry lot under conditions resembling the grazing diet.

Seventy-two pigs, weighing 30 to 45 pounds each, were used to test the supplemental value of cystine and vitamins of the B-complex in rations containing raw soybeans as the only protein ingredient. Basal ration I (B. R. I) was made up of 49 per cent ground raw soybeans, 49 per cent starch, and 2 per cent of an adequate mineral mixture. Basal ration II (B.R. II) contained 98 per cent ground raw soybeans and 2 per cent minerals. The supplemental values of cystine (0.3 per cent of the ration) and a mixture of thiamin, riboflavin, niacin, pyridoxine and calcium pantothenate, alone and in combination, were tested on both basal rations. The vitamins were provided at a level which gave a margin of safety of at least 100 per cent. Vitamin A was provided in all rations in the form of cod-liver oil.

After 70 days on feed, average daily gains and feed consumed per hundredweight gain (the latter indicated in parentheses) were as follows (in pounds): B.R. I 0.48 (422), with cystine 0.72 (349), with B-complex 0.75 (378), with B-complex and cystine 0.86 (326); B.R. II 0.90 (276), with cystine 0.98 (250), with B-complex 0.88 (266), with cystine and B-complex 0.92 (250).

The demonstrated deficiencies of raw soybeans in available cystine and members of the vitamin B-complex indicate that in practice, and for best nutrition, raw soybeans should never contribute the greater percentage of total protein in the ration, but that it should be used in combination with one or more cereal grains and proteins from other plant and animal sources. A good quality legume hay should be provided as well as minerals to balance the ration.

FIG. 67. DAY-OLD PIGS MAY BE RAISED SUCCESSFULLY WITHOUT ACCESS TO SOW'S MILK.

WHOLE MILK-FED PIGS GIVE GOOD RECORD

Two groups of 12 one-day old pigs each were fed entirely in metal batteries for the first three weeks (**Fig. 67**), one group receiving a reconstituted whole dried milk diet supplemented with minerals, while the other group received a synthetic diet. All pigs had received colostrum on the first day of life, but did not nurse thereafter.

At the end of the third week, diets composed of natural feed ingredients replaced the simplified starting diets. The pigs were successfully carried to the accepted weaning age of 56 days with a mortality of 12½ per cent. All mortality occurred in the group receiving the synthetic diet.

The supplemented whole milk-fed group converted each pound of dried whole milk eaten into one pound of body weight during the first three-week period. During this same period, these milk-fed pigs gained 4.32 times their birth weight. This performance is superior to that of pigs raised with their dams. The synthetic diet containing all known nutrients required by swine was far inferior to the milk diet.

Present knowledge of the nutrition of the baby pig from birth to eight weeks is very meager; yet this period is full of interesting possibilities which, when realized, will make contributions both to the practical aspects of swine husbandry and the fundamentals of nutrition.

ANEMIA IN BABY PIGS ON CONCRETE

The hemoglobin level in the blood of a litter of baby pigs kept on clean concrete from birth, dropped from a normal level at birth of 12.1 grams to 5.7 grams per 100 ml. of blood in one week. In 18 days, the hemoglobin had dropped to the critical level of 3.8 grams per 100 ml. of blood. During this time, all pigs made normal growth and appeared thrifty (**Fig. 68**).

This experiment illustrates that sows' milk fails to supply adequate amounts of copper and iron to enable hemoglobin formation to keep pace with body growth. A practical, inexpensive solution is to turn the baby pigs onto good pasture at an early age or to bring soil into the farrowing house.

DIFFERENCES IN NUTRITIVE VALUE OF PHOSPHATED VS UNPHOSPHATED HAYS DIFFICULT TO DEMONSTRATE

As part of a project designed to study the nutritive value of forages grown on soils containing different amounts of phosphoric acid, separate standard feedstuffs analyses were run on soybean hays which also contained a considerable amount of bull grass. The hays were grown on two fields consisting of six plots each receiving 500 pounds of lime and 40 pounds of P_2O_5 (phosphoric acid) per acre. In addition, all plots received potash at the rate of 40 pounds per acre.

The yield of hay from the phosphated plots was about double that from the unphosphated plots. No difference in composition of the phosphated versus unphosphated hays was shown as far as the major nutrients were concerned. If true differences in nutritive value between the two hays exist, then these differences must reside in the less well-known vitamins or minerals, or in differences in the availability of certain nutrients to the animal consuming the feeds.

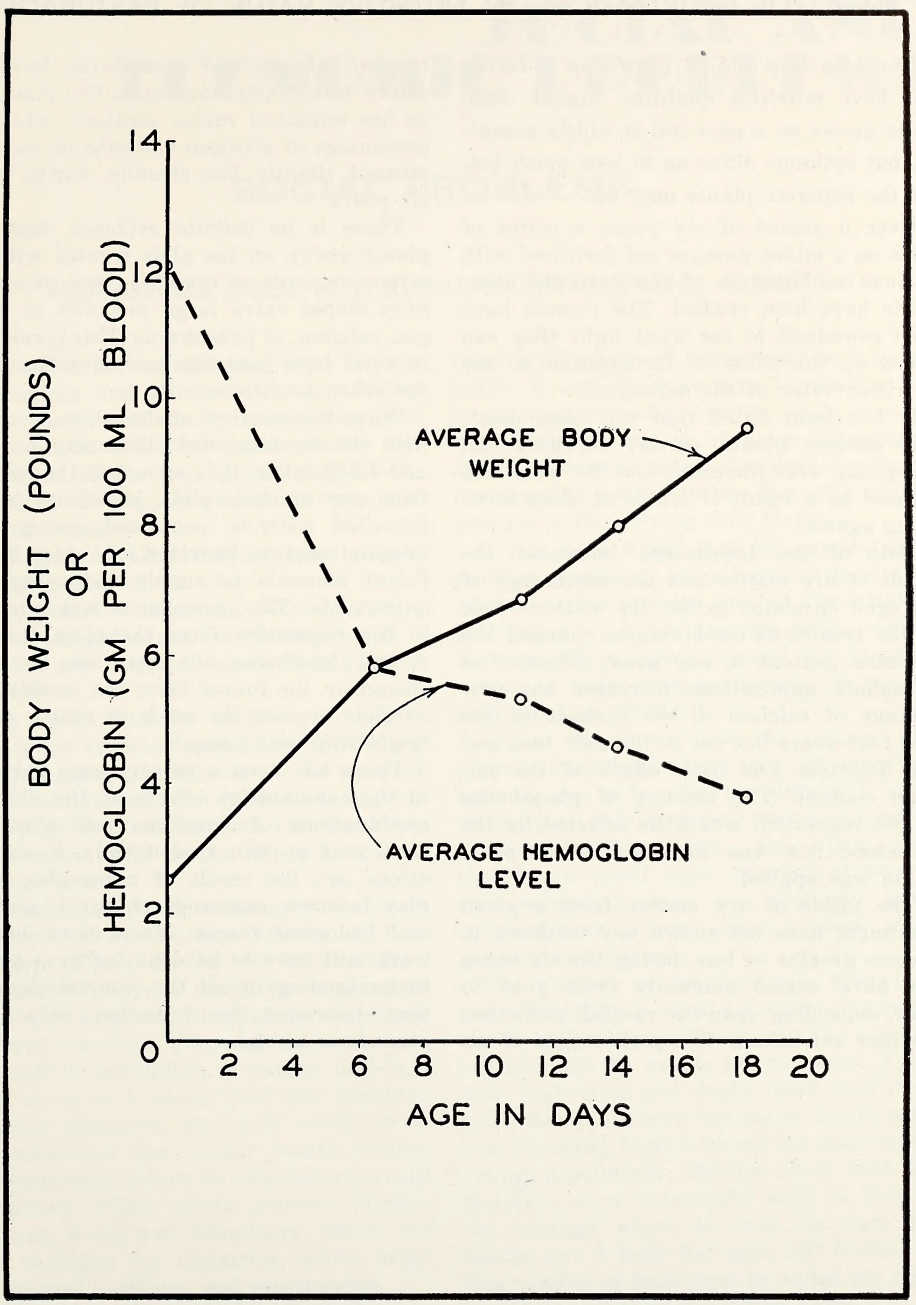


FIG. 68. GROWTH CURVE VERSUS HEMOGLOBIN LEVEL.

EFFECT OF FERTILIZATION ON NUTRITIVE VALUE OF PASTURAGE

The idea that plants grown on a fertile soil have nutritive qualities higher than those grown on a poor soil is widely accepted, but opinions differ as to how much better the superior plants may be.

Over a period of six years a series of plots on a mixed pasture sod fertilized with various combinations of limestone and phosphate have been studied. The records have been examined to see what light they can throw on the effect of fertilization on the nutritive value of the herbage.

It has been found that the more desirable pasture plants, clover, lespedeza and bluegrass, were increased and the weeds decreased as a result of either of these fertilizing agents.

Both of the treatments increased the yields of dry matter and the percentage of nitrogen (protein) in the dry matter. None of the treatment combinations changed the carotene content to any great extent. The phosphate applications increased the percentage of calcium in the herbage in the last four years but not in the first two, and the limestone had little effect on the calcium content. The amount of phosphorus in the vegetation was little affected by the limestone but was increased when phosphate was applied.

The yields of dry matter from a given treatment have not shown any tendency to become greater or less during the six years but have varied markedly from year to year, depending upon the rainfall and other weather conditions. The percentages of nitrogen, calcium and phosphorus have not shown this yearly variation. The phosphorus has remained rather constant, while the percentage of nitrogen and calcium have decreased slightly but steadily during these six years.

There is no definite evidence that the plants grown on the plots treated with the larger amounts of limestone and phosphate have stored extra large amounts of nitrogen, calcium, or phosphorus. This is contrary to what some investigators have found under other conditions.

When the chemical analyses are compared with the recommended allowances for beef and dairy cattle, it is seen that the herbage from any of these plots, including the unfertilized controls, contained enough protein and calcium, provided it is eaten in sufficient amounts to supply the energy requirements. The phosphorus was adequate in the vegetation from the plots that received phosphates, but there was not quite enough in the forage from the unphosphated plots to meet the needs of young, rapidly-growing beef animals.

There has been a rather large variation in the comparative effects of the different combinations of limestone and phosphate from year to year. Undoubtedly, these variations are the result of a complex interplay between numerous chemical, physical and biological forces. Much more detailed work will have to be done before a proper understanding of all the interrelationships that determine the nutritive value of a plant is to be had.

SOCIAL AND ECONOMIC PROBLEMS

SOCIAL PROBLEMS

MEASURING NEED FOR RURAL HOSPITALS AND CLINICS

The major factors affecting need for rural hospitals and clinics are: population density and distribution; topography and roads; health conditions and needs; age distribution of the population; racial composition of the population; and income and levels of living.

Studies of the present distribution of hospitals by states shows that:

As population thins out, hospital service areas get larger but the number of people per hospital community gets smaller.

This means that the advantages of having a large hospital tend to be limited by the advantages of convenience. In spite of the automobile and good roads, it is important to provide small hospitals and community clinics for rural people, living in sparsely settled areas.

The best size of a hospital service area is one in which a maximum amount of hospital care of good quality can be provided.

Figure 69 shows a tentative mapping of actual and proposed hospital service areas in North Carolina. Some of the areas are too small in population to justify hospitals of 50 or more beds—a generally accepted minimum standard. For such small areas, it is suggested that public health centers and community clinics be established—small institutions which would provide preventive care, X-ray and laboratory, offices and other facilities for obstetrics, minor surgery, general medicine, and emergencies.

In detailed surveys of individual communities, because of topography or type of roads, it may be necessary to change the location of hospital service area boundaries. Driving time is of more importance than the actual miles. Hospital communities must be smaller in the Mountain region because of the driving time factor.

It has been found that the normal percentage occupancy of a hospital is closely related to the average size of the hospital population—i. e., its average daily census. To meet the varying demand for hospital service a safe average margin of vacant beds must be provided.

Figure 70 shows how the normal and actual percentage occupancy of hospitals vary by size of hospital population. A higher ratio of beds to population is needed in small communities than has often been thought. A small rural hospital at 60 per cent occupancy may be relatively more crowded than a large urban hospital at 80 per cent occupancy.

The number of hospital beds needed by any population —rural or urban—is determined by health conditions and the age distribution of the people in that area. Areas with high birth and death rates need more beds than those wtih low rates. Death rates are, of course, higher among old than among young populations. Studies show that the residents of a community need to use, on the average, about 30 beds for each 100 deaths and 3 beds for each 100 births. To this number of beds must be added the margin of vacant beds mentioned above.

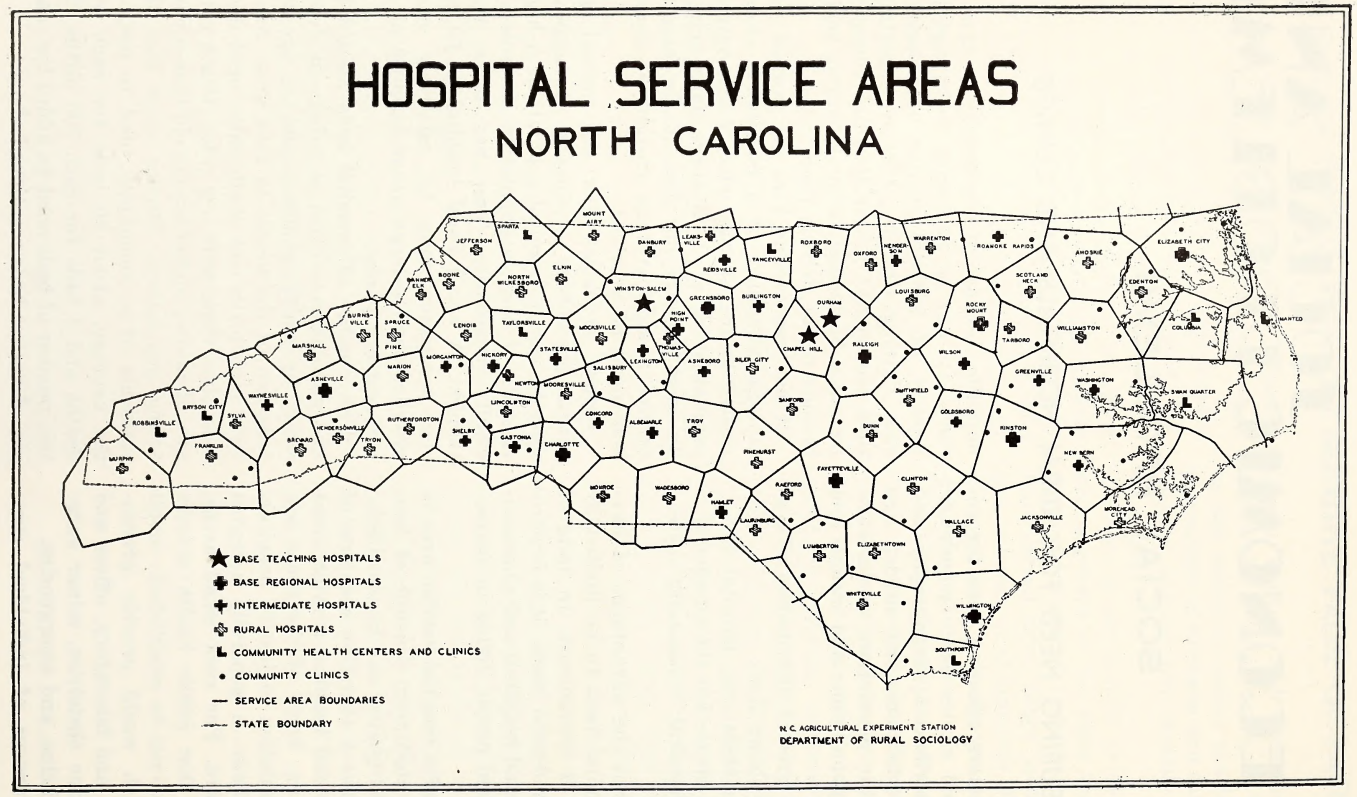


FIG. 69. THESE PROPOSED HOSPITAL SERVICE AREAS ARE DESIGNED TO PROVIDE HOSPITALS AND CLINICS WITHIN A SHORT DRIVING DISTANCE OF ABOUT 98 PER CENT OF THE RURAL POPULATION OF THE STATE. THE LOCATION OF HOSPITALS AND CLINICS ARE ALSO ARRANGED TO ELIMINATE UNNECESSARY AND EXPENSIVE DUPLICATION. (THIS MAP DOES NOT NECESSARILY CORRESPOND WITH THE FINAL PLAN TO BE PRESENTED TO THE STATE BY THE NORTH CAROLINA MEDICAL CARE COMMISSION. FURTHER STUDY AND CRITICISM BY RESIDENTS OF EACH AREA ARE NEEDED TO INSURE PROPER LOCATIONS OF HOSPITALS AND HOSPITAL SERVICE AREA BOUNDARIES.)

Effective hospital service for rural people depends upon close working relationships between small and large hospitals.

The problem of financing hospital service is closely related to the incomes received by the people. This problem is particularly acute among Negro people who have a relatively low economic status. Studies show that North Carolina had a relatively low income and a low level of hospital usage in both 1940 and 1944. On the average, North Carolinians use less than half of the days of hospital service which good standards require.

AGE STRUCTURE OF RURAL POPULATION IS CHANGING

North Carolina's rural-farm population, as compared with the urban, is characterized by a very high proportion of children and young people; a high proportion of elders or mature adults many of whom are beyond the years of peak production; and a low proportion in the productive years of life. This picture may become more vivid

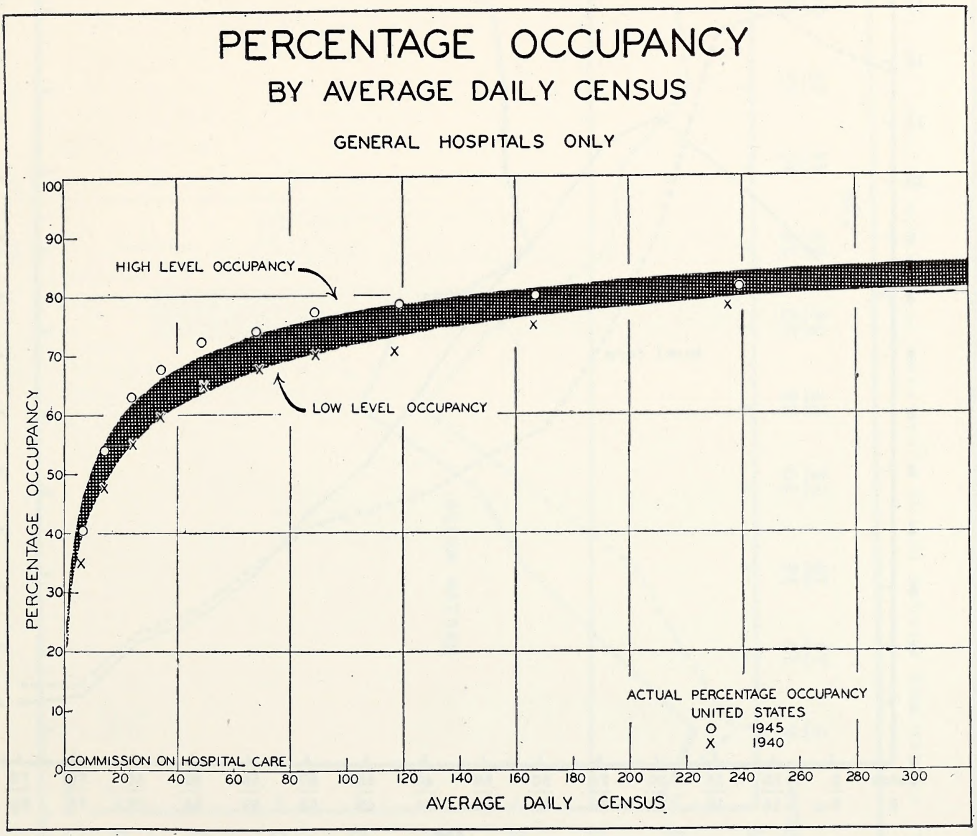


FIG. 70. SMALL ISOLATED COMMUNITIES MUST DEPEND ON SMALL HOSPITALS AND CLINICS. THIS CHART SHOWS THAT SMALL HOSPITALS CAN NOT OPERATE AT A HIGH PERCENTAGE OCCUPANCY AS EASILY AS CAN A LARGE HOSPITAL. SMALL HOSPITALS ARE, THEREFORE, LIKELY TO BE MORE EXPENSIVE THAN LARGE ONES----IF QUALITY OF SERVICE IS TO BE PROVIDED.

by referring to **Figure 71** which shows a percentage distribution of the rural-farm and urban populations by age.

This age profile is the result of a combination of four factors: the birth rate of the rural population is much higher than the urban; a very large proportion of the city-ward migrants are young adults between 16 and 25 years of age; ruralward migrants apparently have passed their period of rapidly changing, however. There were 58,- highest production; and expectation of life is still higher in rural areas.

These characteristics are constantly and 423 fewer children under 10 years of age in 1940 than in 1930. Youths under 10 years of age on farms decreased 10.4 per cent or 46,212 during the same period. This rapid and very significant change in a single decade is shown in **Figure 72.**

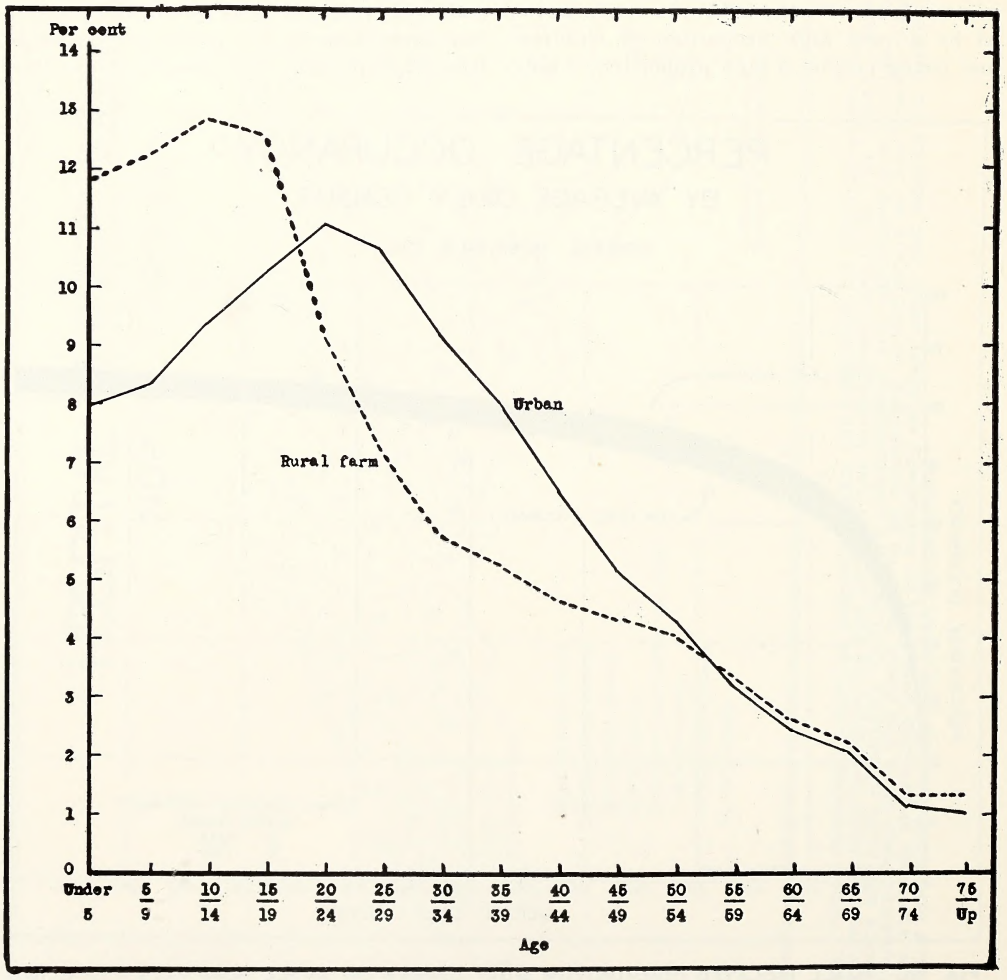


FIG. 71. PERCENTAGE DISTRIBUTION OF THE RURAL-FARM AND URBAN POPULATIONS BY AGE, NORTH CAROLINA, 1940.

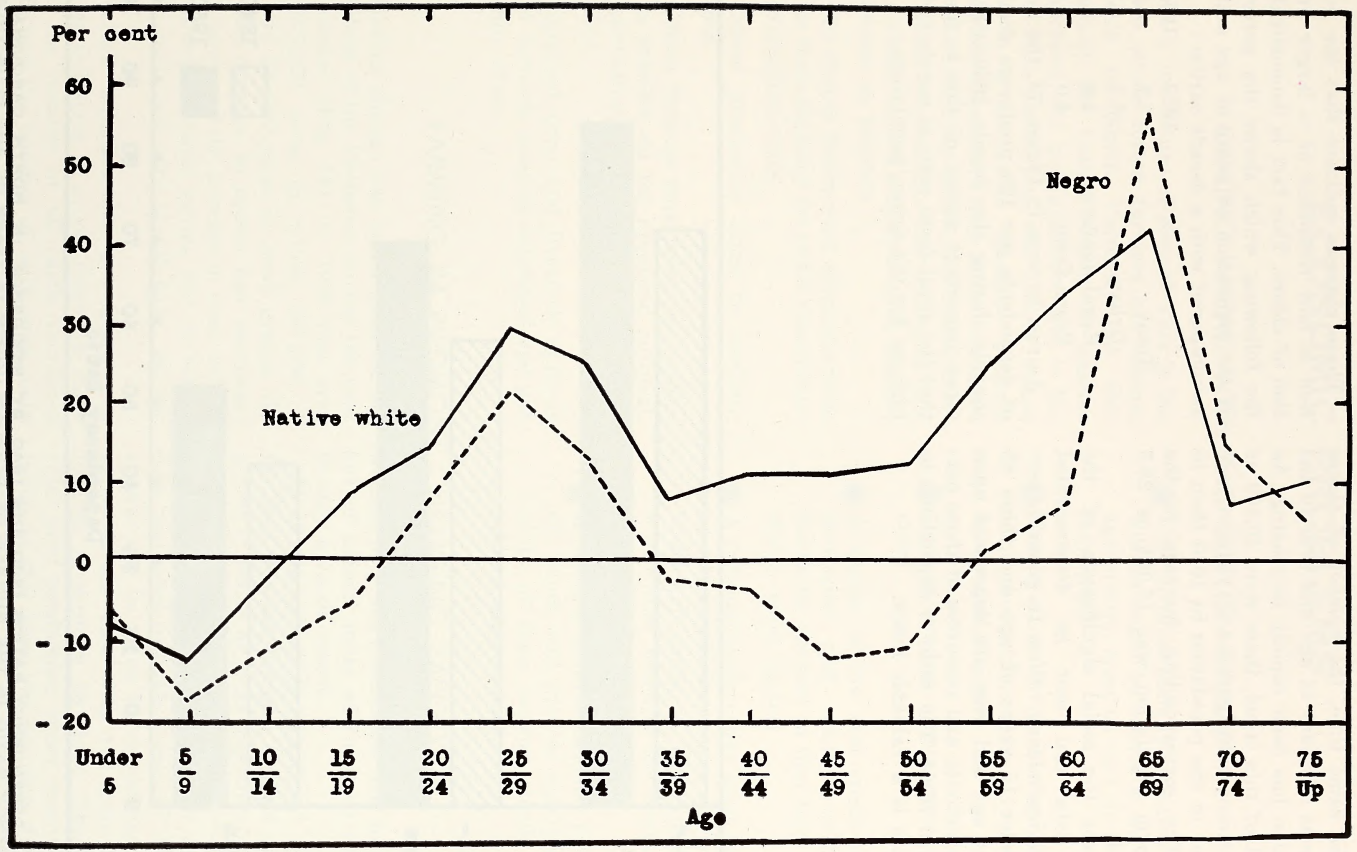


FIG. 72. PERCENTAGE CHANGE IN THE RURAL-FARM POPULATION BETWEEN 1930-1940, BY COLOR, NORTH CAROLINA.

At the same time, the number of elders or persons 65 years of age and over in the population has been rapidly increasing. As a result of this trend, there were 40,869 or 35.3 per cent more persons 65 years of age and over in the population in 1940 than in 1930. The corresponding increase in the rural-farm population was 15,001 or 23.5 per cent.

Perhaps the social significance of the above data can best be demonstrated through *dependency ratios.* In general, persons under 15 years of age and those 65 years of age and over are dependent upon the productivity and resources of those persons aged 16-64. The ratio of dependents to producers is a valuable index.

These changes indicate that the population is now composed of a larger proportion of elders. This fact is demonstrated in the following which shows the percentage of the population 65 years of age and over as compared with a decade earlier:

	1930	1940
Total	3.7	4.5
Urban	3.1	4.1
Rural-nonfarm	3.6	4.1
Rural-farm	4.0	4.8

As can be seen in **Figure 73,** the number of dependents per 100 producers decreased sharply during the decade 1930-1940. Another important aspect of this is the fact that the rural-farm ratio is nearly twice as high as for the urban population.

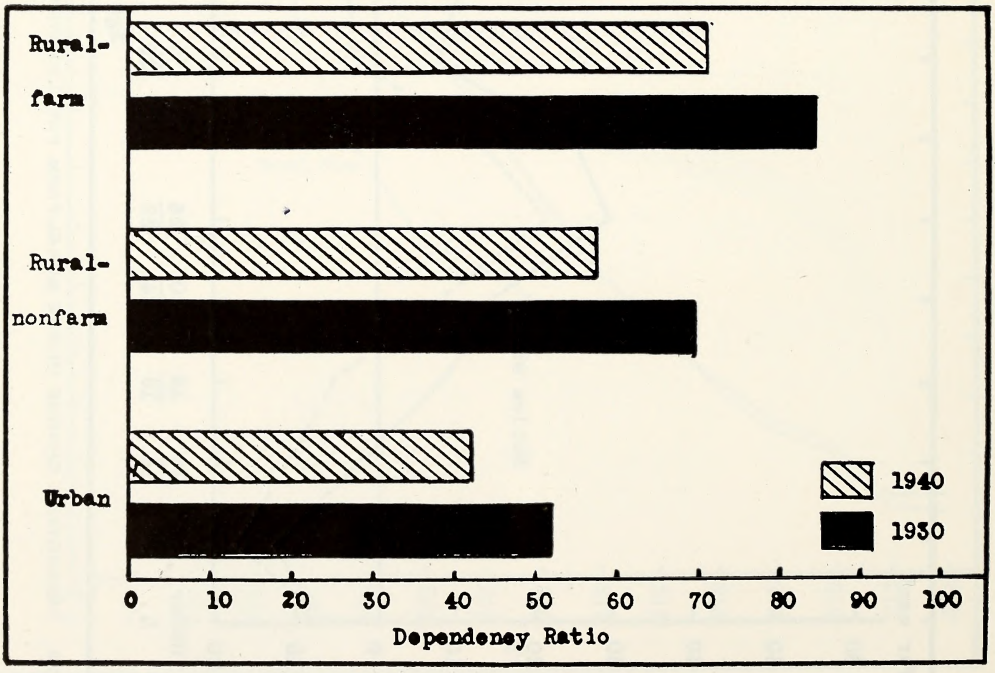


FIG. 73. DEPENDENCY RATIOS 1930 AND 1940 BY RESIDENCE IN NORTH CAROLINA. (DEPENDENCY RATIO IS THE NUMBER OF PERSONS UNDER 15 YEARS OF AGE PLUS THOSE 65 AND OVER PER 100 PERSONS AGED 15-64.)

ECONOMIC PROBLEMS

LOOKING AHEAD WITH THE COTTON FARMER

What is the future of cotton? This is the question which cotton farmers are asking, not only in North Carolina, but also throughout the Cotton South. To answer this question, the land-grant colleges in the Cotton Belt states and the USDA joined forces in a southwide research project. Almost two years have been spent in assembling and analyzing all available production and market information. The results of this study, which will be available soon, may be summarized as follows:

- The Cotton South must eliminate from its farm economy its small uneconomic production units.
- Cotton production must be mechanized.
- Cotton farmers must adopt as rapidly as possible all the approved cultural, harvesting, and soil conservation practices.
- Balanced crop and livestock systems of farming must be developed and put into effect.
- The surplus farm population, which will no longer be needed in an efficient agriculture, must be used in new rural industries.
- The system of marketing Southern farm products must be made more efficient and flexible.
- New processing plants must be provided.
- A system of low cost credit must be developed and made available to Southern farmers so that they can obobtain more capital.
- A national trade policy must be adopted which will encourage international trade and assist in the expansion of world-wide markets for Southern export commodities.
- A national farm commodity price policy, which will provide maximum stability of farm income, should be developed and adopted.

FARMING IN PIEDMONT CHANGING RAPIDLY

A marked change has taken place in the agriculture of the Piedmont during the past two decades (**Fig. 74**). In 1926 this area grew 527,000 acres in cotton, 387,000 in corn, and 209,000 acres in small grains. By 1944, the acreage in cotton had decreased 56 per cent, and the acreage in corn, 22 per cent. Acres in small grains had increased 54 per cent, and acre in all hays, 94 per cent.

Livestock numbers did not change as much as did acres in crops. Over the same period the number of all cattle increased 47,400, and the number of milk cows, only 14,200. The number of hogs decreased; the number of poultry increased. The total number of animal units of livestock increased to only a small extent.

If all the wheat is considered available for feed, the net increase in feed over this period in terms of total digestible nutrients was 19 per cent. Would farm income have been increased if this additional feed had been marketed through livestock? A partial answer can be given by comparing the net value of the feed with the returns from feeding it through livestock. The returns from milk production under conditions existing in this area are not very favorable. Under usual conditions it requires about 2.4

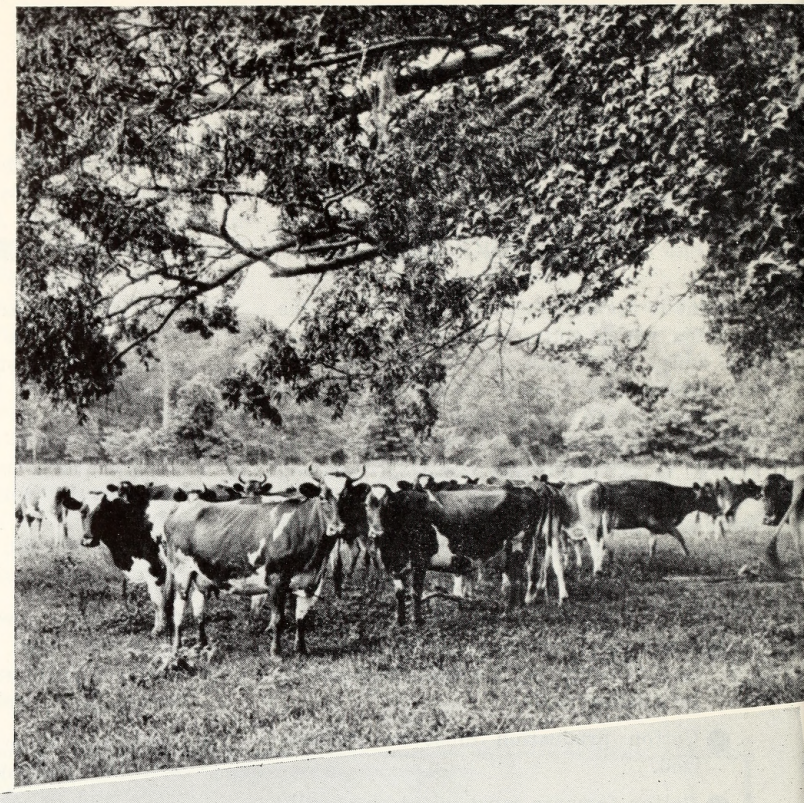


Fig. 74a. Farm scenes in the Piedmont.

acres of pasture and 1.6 acres of cropland, or 4.0 acres to support a cow. The usual production from one cow is 3,950 pounds of milk and 75 pounds of veal. The net value of the feed eaten by a cow is $63, whereas the net value of the product produced is only $71 or a difference of only $8, which is hardly enough to pay for the extra trouble of caring for a cow for a year.

What would be the effects on this situation if farmers followed the most approved practices of crop and livestock production? Under these conditions, the amount of land required to care for a cow would be 1.5 acres of pasture and 1.2 acres of cropland, or a reduction of 1.3 acres. Because of the improved yields, the net value of the feed on this land would be $80. However, if it were fed to a cow producing 6,000 pounds of milk, the net value of the product would be $125, or an increase of $45 for marketing the feed through the cow. In addition, since the amount of land is reduced, more cows can be carried on the same size farm. These data mean that, if farmers in the Piedmont wish to make a success of livestock production, they must use livestock of high production and adopt approved practices for both crops and livestock.

FARM MECHANIZATION IS ON THE MARCH

Many farmers of this state have become efficiency conscious, if the rate of farm mechanization is to be taken as an indication. This is shown by the change in number of tractors from 7,909 in 1925 to 31,189 in 1945. Most of this increase came from 1940 to 1945, during which period the number of tractors increased by 18,433, or 144 per cent. The geographic distribution of tractors, however, is not uniform (Fig. 75). It varies with type-of-farming, physical conditions, and other factors. The heaviest concentration of tractors is in the Central Piedmont where there is one tractor for each 150 acres of cropland. With the exception of the Mountains, tobacco areas have the smallest number of tractors, or about one tractor for each 300 acres of cropland.

Mechanized equipment, with the exception of the combine, has been used only to a very limited extent in harvesting the major crops of the state. In 1943 only 0.6 per cent of the corn crop was harvested by a mechanical picker and only 2.5 per cent was harvested with a husker-shredder. None of the corn cut for silage was harvested with a field harvester. Cotton was harvested with a mechanical picker in the state for the first time during the 1945 season. One mechanical picker operated in 1945 and three in 1946. In addition to mechanical pickers, six two-row tractor mechanical strippers were used in harvesting cotton in 1946.

There is no doubt that the level of mechanization can be further increased. The level land of the Coastal Plain area is suited to the use of mechanical equipment. The Piedmont, although rolling, is not as a rule too steep to permit fairly efficient use of mechanized equipment. The Mountain area does not lend itself to an increase in mechanization as much as the Coastal Plain and Piedmont areas.

If additional mechanization is to be accomplished, the size of farms must be increased to the point that will permit efficient utilization of machinery and equipment and also justify the use of the more expensive types of equipment. In some cases, it will be necesary for types of equipment to be perfected so that they will be better adapted for use on smaller farms. In other cases, the use of more expensive equipment will have to be obtained on a custom basis.

The application of mechanized equipment to crop and livestock enterprises tends to reduce the amount of labor necessary to produce a unit of product and eliminate the need for surplus labor on the farm a good part of the year to meet peak periods.

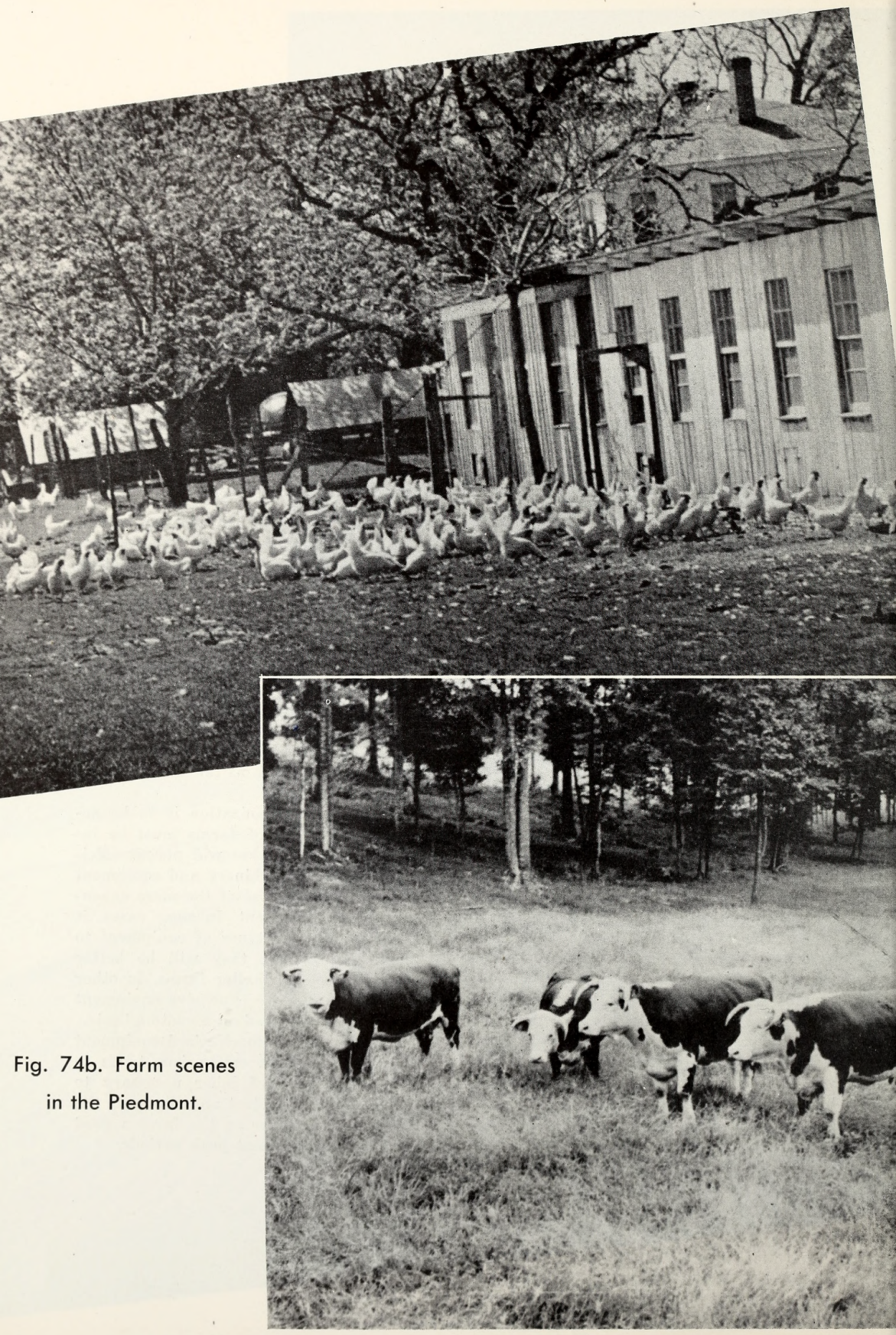


Fig. 74b. Farm scenes in the Piedmont.

FARMERS NEED TO GIVE MORE ATTENTION TO CONSUMER PREFERENCES

A study of consumer preferences for sweet potatoes now being conducted by the North Carolina Experiment Station has directed increased attention to the importance that should be attached to the wants of consumers in developing a marketing program for farm products **(Fig. 76)**. In fact, it's the housewife with the market basket who determines to a considerable extent how farm products are marketed. This study indicates that her likes and dislikes, her opinions and prejudices, and her knowledge or lack of knowledge—all are items that determine her behavior in the market place.

Preliminary findings indicate that:

- Consumers in the lower-income class bought nearly 50 per cent more sweet potatoes than did those in the high-income classes.
- Eighty-five per cent preferred the Porto Rican variety.
- Eighty-four per cent expressed a preference for a medium size sweet potato — principally because of economics in fuel and time of preparation.
- Consumers in the higher-income class usually are not price conscious. In other words, they are willing to pay high prices for a quality products.
- Prevailing standards for the U. S. No. 1 grade allow too much leeway as to size.
- Consumers will buy products of different qualities, if price differentials are established that reflect variation in quality.

The results of this study have practical application in that they can be used in action programs designed to help farmers increase the efficiency of their marketing practices. Some of the most significant of the applications include the following:

Sweet potato producers must give greater attention to producing the types and varieties desired, to grading potatoes based on consumer demand, and to making certain that prices charged are in accordance with quality. Manufacturers and processors have long recognized the importance of giving attention to similar practices in their business operations.

Retailers can make practical applications of the findings of this study in developing a better merchandizing program. They can do this by determining the extent to which their customers are grouped into various income classes and then by stocking their produce bins with grades of sweet potatoes in the proportion that such grades are demanded.

Since per capita consumption of sweet potatoes is lower among high income families, indications are that, if this crop is to compete effectively with many of the high energy foods now available, sweet potatoes will have to be placed on the market as a uniform product of high quality to supply the demand of these consumers.

OPERATING POLICIES AND PRACTICES OF FARMERS' CO-OPS

The success of farmer-owned cooperatives means increased income to many of North Carolina's farm operators. The Experiment Station, therefore, has begun a broad study of policies and practices of these associations. In an effort to determine ways in which organizations can better serve members, the first phase of this study has been directed to membership relations of cooperative associations.

Preliminary results indicate that neither members, non-members, nor the public in general have much information on the manner in which cooperatives conduct their bus-

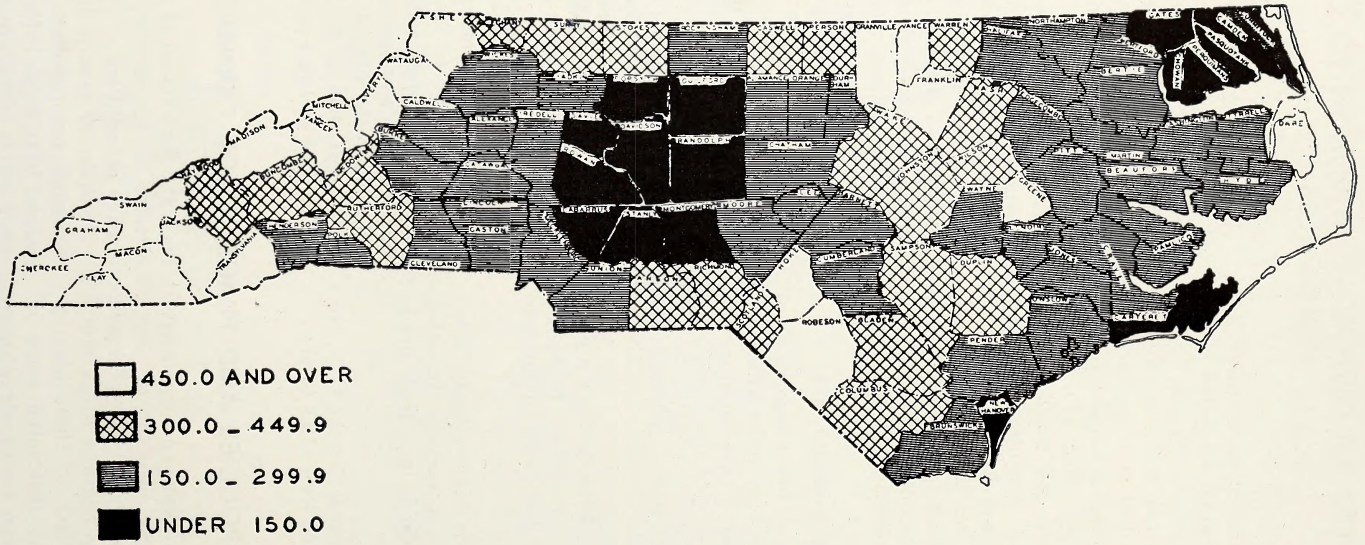


FIG. 75. ACRES OF CROPLAND PER TRACTOR, NORTH CAROLINA, 1945.

iness activities. Furthermore, such ideas about cooperatives which are prevalent are often erroneous. The information obtained in this study should enable cooperatives to improve their educational work and to develop an effective public relations program.

FIG. 76. DEPENDING UPON INCOME, QUALITY OF SWEET POTATOES AVAILABLE, AND CONTEMPLATED USE, CONSUMERS INDICATED DEFINITE PREFERENCES FOR SWEET POTATOES.

WINTER COVER CROPS MAKE SOIL LESS COMPACT

The soil on which a winter cover crop experiment is being conducted at the Upper Coastal Plain Station is subject to packing and in general is in poor physical condition. An effort was made in 1946 to determine the effect of the cover crops on the soil packing. A penetrometer was used to determine how deep a pointed rod would penetrate into the soil if dropped from a given height. The depth of penetration of the rod was much less after no cover than after vetch in both the cotton and the peanut plots (**Fig. 77**). In other words, the soil was very compact in the no cover plots. For example, in the peanut plots penetration into the soil on which vetch had been turned under was 45 per cent greater than after no cover. Thus, the use of cover crops is seen to result in a loose, easily penetrated soil. This is important in crop production, particularly with peanuts, since peanut pegs must penetrate the soil before fruit development occurs.

In addition to the direct effect of cover crops the type of rotation also affects the soil compaction. In the cotton plots the depth of penetration after no cover in the cotton-corn rotation was greater than in the cotton-peanut rotation. This effect of rotation also occurred in the vetch plots. In the case of peanuts there is practically no organic matter returned to the land, while with corn a high amount of organic matter in the form of stover and roots is returned.

WINTER COVER CROPS FAIL TO STOP SUMMER EROSION ON SANDY SOILS

An experiment to determine the effect of cover crops and other organic residues in reducing soil loss from bright tobacco land, either while growing on the land or after they are turned under, is showing these rather important results: Soil losses occur mostly during the summer, and cover crops, commonly grown on sandy tobacco land, cause little reduction in erosion during this summer period.

The fact that the summer is the vulnerable period rather than other seasons of the year is illustrated in **Figure 78.** Soil loss during June, July and August was approximately 80 per cent of the annual total, or around four times the loss occurring during the remaining nine months. This was the case not only with each of the different cover crops but also where no cover crop was seeded. Detailed results of the experiment showed there was a slight increase in the soil loss during the spring months where no winter cover crop was turned and also following weeds of the previous summer, but was not sufficient to change the annual picture materially. Wider differences in soil loss with and without cover crops might be expected if hard rains should occur during these spring months. However, the summer type storms usually do not begin until later. This seasonal soil loss pattern shows clearly that conservation practices for tobacco fields should be used which are effective during these summer months.

Turning under cover crops of rye, even when stimulated with nitrogen in the fall at seeding, reduced soil loss only about one-half ton per acre, and turning under red top sod or weeds caused no decrease when compared with the no cover plot. Rye grass

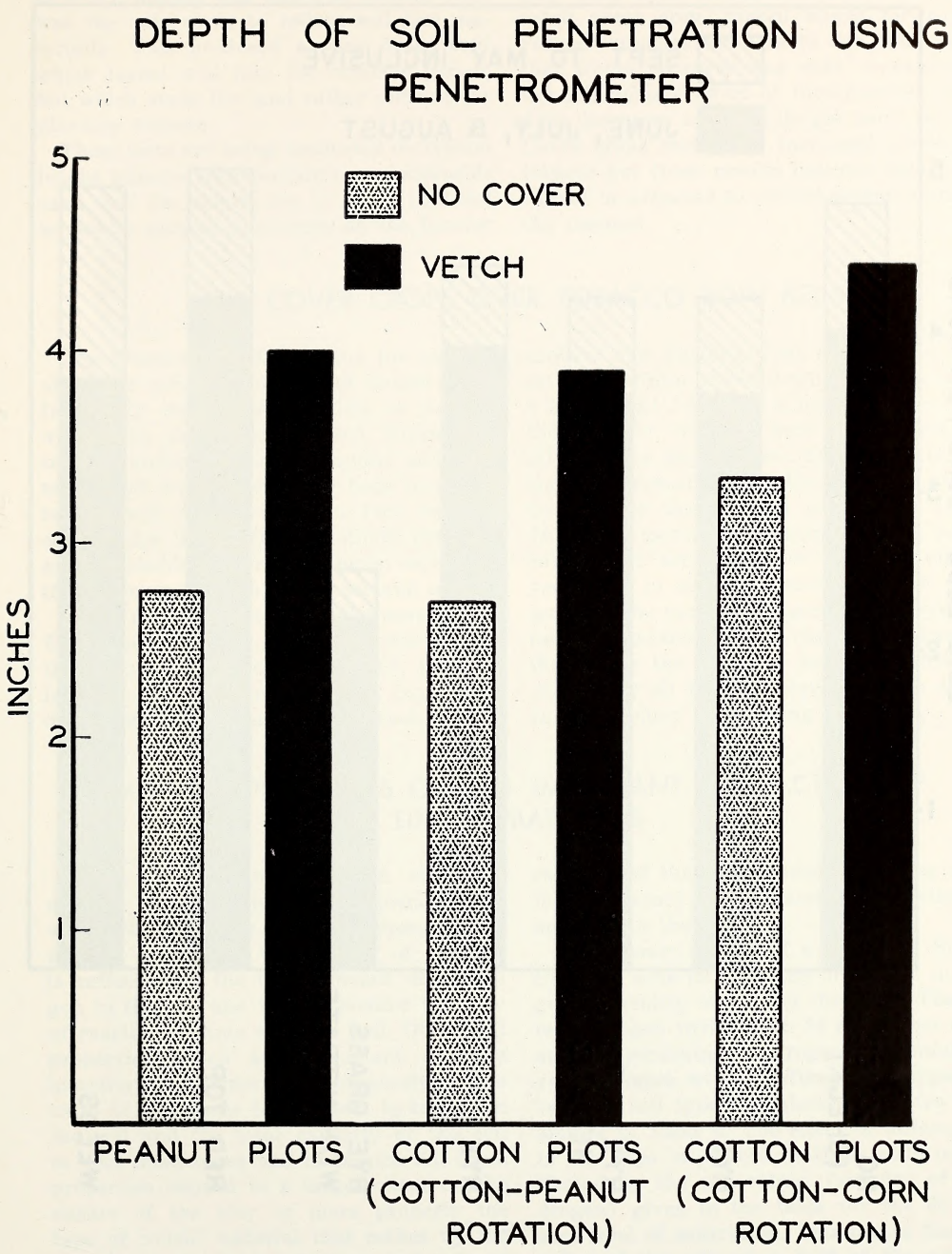


FIG. 77. COVER CROPS AND TYPE OF ROTATION AFFECT THE COMPACTNESS OF THE SOIL AS MEASURED BY THE DEPTH OF PENETRATION OF A SLENDER STEEL ROD.

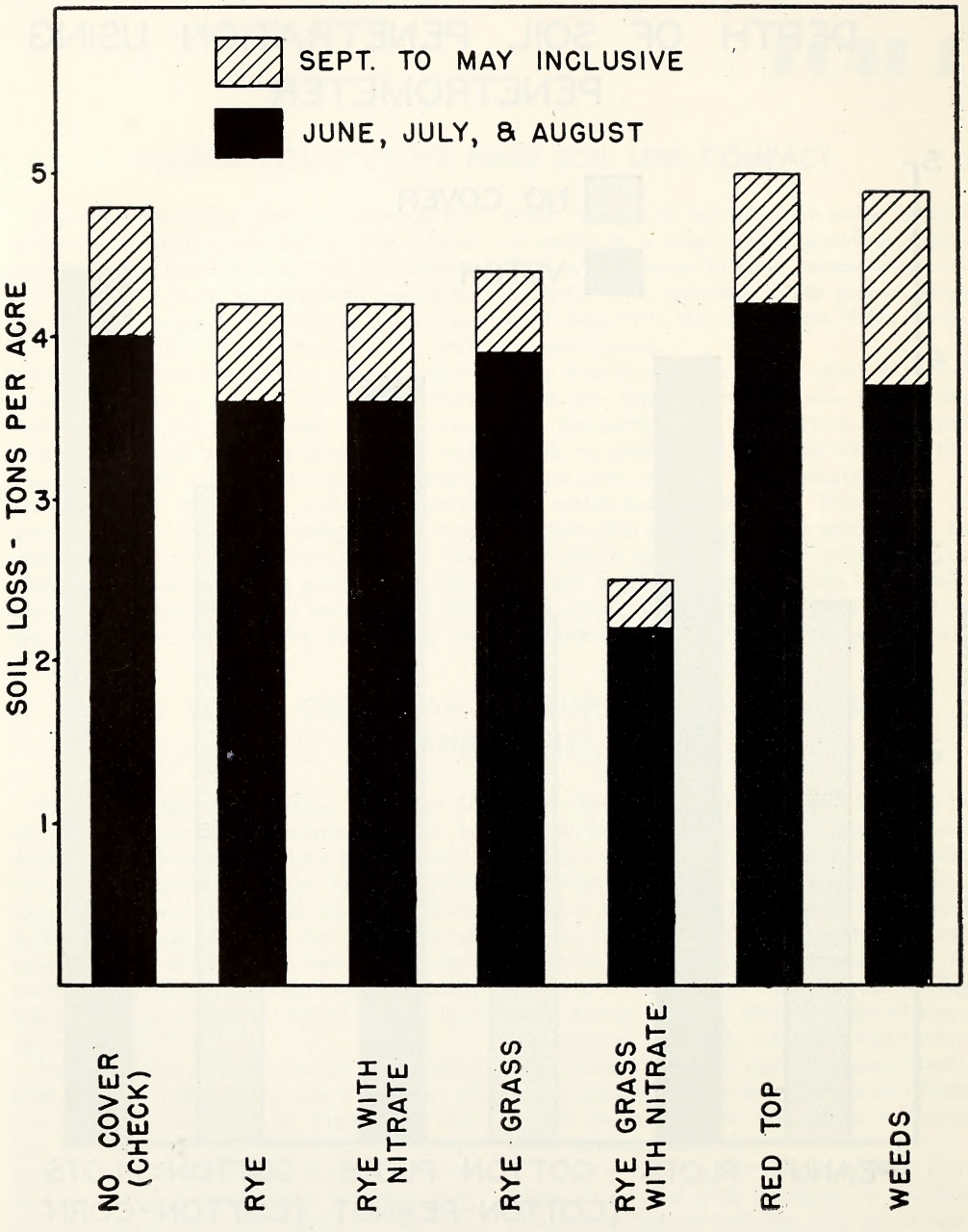

SEPT. TO MAY INCLUSIVE
JUNE, JULY, & AUGUST
SOIL LOSS - TONS PER ACRE
5
4
3
2
1
NO COVER (CHECK)
RYE
RYE WITH NITRATE
RYE GRASS
RYE GRASS WITH NITRATE
RED TOP
WEEDS

FIG. 78.

to which nitrate was added at seeding time was the only cover to reduce soil loss materially. This produced a very dense turf which lasted well into the summer period, but which made the land rather difficult for planting tobacco.

These tests are being conducted on typical bright tobacco soils containing considerable sand, and the results are in direct contrast to results secured previously on the heavier clay soils near Statesville. There, a rye-vetch cover crop, turned under for corn, reduced summer soil loss to less than half that where no cover was used. Apparently the soil holding effect of incorporated residues decreases as the soils get more sandy. Cover crops materially increased yields of tobacco but these results indicate that they cannot be expected to control erosion during the summer.

SEED COVER CROPS OVER TOBACCO ROW BEDS

The preparation of land for the seeding of winter covers or other fall seeded grain frequently encourages erosion at a time when little should be expected. Disking or turning under all surface residue and flattening out any contour row beds increases both runoff and erosion. In fact, seeding cover crops in the fall sometimes destroys more protection than it produces, especially if a vigorous growth is not secured early.

Tests conducted at the Soil Conservation Experiment Station, Raleigh, have shown that winter covers can be seeded, particularly on tobacco land, without completely destroying either the surface trash or the contour row pattern. Just seeding the rye or other winter cover down the rows with a grain drill following a light disking over the beds, or with no land preparation at all except a stalk cutter, appears to be all that is necessary. Both the ease and effectiveness of this method is striking (**Fig. 79**). This method of seeding winter cover carries the contour effect over the entire year and, in addition, saves the row pattern for the next year, once a good system has been established. At the proper time in the spring the land can be disked without destroying all the row signs and the same rows rebedded in breaking the land.

CHEMICAL PROPERTIES OF SOIL IMPORTANT IN REACTION OF LIMING MATERIALS

When lime is added to the soil, the amount required and the frequency with which it should be applied depend on a number of factors. The acidity of the soil is reflected by the total amount of hydrogen in the soil and this influences the rate of reaction of lime with the soil. Other soil properties which are important are the quantity of calcium and magnesium, the ratio of the bases to the acid hydrogen in the soil and the total capacity of the soil to hold these bases and hydrogen. All these properties depend to a large extent on the nature of the clay or more properly the type of colloid material that makes up the soil. To study the mechanism and rate of reaction of liming materials with the soil, it is necessary to characterize the colloidal material in the soil.

Preliminary results of a survey of North Carolina soils indicate the difference in degree of acidity of soils of the state. The total hydrogen varies from 38 to 100 per cent and the percentage hydrogen was found to vary as much within different soil types as between soil types, as shown by a few examples in Table 6. The effect of differences in the type of colloid in these soils is reflected by the pH values (activity of hydrogen) given in the table for the 50 per cent level of saturation. This means the pH value of the soil when half of the acidity

FIG. 79. A TOBACCO FIELD WITH RYE WINTER COVER OVER THE ROW BEDS, SHORTLY AFTER SEEDING (TOP), AND IN LATER FALL (BOTTOM). THE CONTOUR ROWS TOGETHER WITH SURFACE RESIDUE AND RYE GIVE COMPLETE PROTECTON. ROW IDENTITY IS RETAINED FOR NEXT YEAR.

(hydrogen) is neutralized by lime. Where the pH levels are relatively high at this point a preponderance of the kaolinitic type of soil colloid is indicated. Lower pH values probably indicate the presence of increasing proportions of the montmorillonitic type of colloid. Information of this nature may prove to be a valuable aid in the classification of soil type and fertility ratings of soil.

TABLE 6. IN THE SUBSOIL THE PERCENTAGE OF TOTAL HYDROGEN AND THE pH AT 50 PER CENT SATURATION VARY WITHIN AND BETWEEN SOIL TYPE.

Soil Type	County	% Hydrogen	pH at 50% saturation
Alamance	Chatham	87	5.5
Alamance	Stanley	100	6.4
Georgeville	Chatham	40	4.8
Georgeville	Stanley	98	6.0
Cecil	Rutherford	100	6.6
Cecil	Wake	78	6.1
Davidson	Davidson	67	5.6
Davidson	Davis	79	6.1
Ashe	Macon	100	6.6
Ashe	Polk	89	6.9
Kaolinite		50	6.4
Montmorillonite		50	4.5

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"Cotton and Soybean Seed Treatment Studies."

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OFFICERS AND STAFF OF THE NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

December 1, 1946

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J. P. Ammerman, Jr. ..... *Foreman, Animal Husbandry*
N. L. Johnson ..... *Herdsman, Animal Husbandry*
L. Y. Parker ..... *Foreman*
E. A. Melin ..... *Herdsman, Dairy*

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B. F. Mills ..... *Foreman*

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Luke A. Forrest, M.S. ..... *Assistant Soil Conservationist*
Sidney H. Usry, B.S. ..... *Project Engineer*
J. O. Knott ..... *Farm Foreman*

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Herbert Allen ..... *Foreman*

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J. Gordon Blake, B.S. ..... *Assistant Superintendent*
C. O. Bollinger ..... *Poultryman*
[3]E. W. Faires, B.S. ..... *Assistant Dairying, Bureau of Dairy Industry, USDA*

MOUNTAIN BRANCH STATION, WAYNESVILLE

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J. E. Love ..... *Poultryman*
W. M. Whisenhunt ..... *Foreman*

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UPPER COASTAL PLAIN BRANCH STATION, ROCKY MOUNT

R. E. Currin, Jr. ..... *Assistant Director in Charge*
Wm. Allsbrook ..... *Foreman*

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* The six branch station farms are owned and operated by the North Carolina Department of Agriculture, and the employees on these farms are members of the Department of Agriculture staff.
[1] In cooperation with Bureau of Plant Industry, Soils and Agricultural Engineering, USDA.
[2] In cooperation with Bureau of Animal Industry, USDA.
[3] In cooperation with Bureau of Dairy Industry, USDA.
[4] In cooperation with Bureau of Agricultural and Industrial Chemistry, USDA.
[5] In cooperation with Soil Conservation Service, USDA.
[6] In cooperation with Bureau of Agricultural Economics, USDA.
[7] In cooperation with Tennessee Valley Authority.

FINANCIAL REPORT

of the

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

FOR THE YEAR ENDED JUNE 30, 1946

CERTIFICATION

We, the undersigned, certify that the receipts and expenditures shown in this report from Federal funds and as offset to Bankhead-Jones funds are correct; that the expenditures were solely for the purposes set forth in the acts of Congress approved March 2, 1887 (Hatch), March 16, 1906 (Adams), February 24, 1925 (Purnell), May 16, 1928 (Hawaii), February 23, 1929 (Alaska), March 4, 1931 (Puerto Rico), June 29, 1935 (Bankhead-Jones, Title I), June 20, 1936 (Alaska), and March 4, 1940 (Employer Contributions to Retirement); that the expenditures are in accordance with the terms of said acts so far as applicable to this station; and that properly approved vouchers are on file for all expenditures.

We further certify that the sum of $ NONE was the total amount earned as interest on the deposit of Hatch, Adams, Purnell, and Bankhead-Jones funds and that this amount has been remitted to the Treasurer of the United States through the United States Department of Agriculture.

(Signed) L. D. BAVER,
Director of Experiment Station

(Signed) J. G. VANN,
(Legal Custodian of Federal Funds)
Assistant Controller
North Carolina State College of
Agriculture and Engineering

(Seal of Institution)

RECEIPTS AND EXPENDITURES UNDER HATCH, ADAMS, PURNELL, AND BANKHEAD-JONES ACTS, AND THE STATE OFFSET REQUIRED BY THE BANKHEAD-JONES ACT

Fiscal Year Ended June 30, 1946

RECEIPTS

	Balance From 1945-46	Receipts From U. S. Treasury	Total
FEDERAL FUNDS:			
Hatch	$ None	$ 15,000.00	$ 15,000.00
Adams	None	15,000.00	15,000.00
Purnell	None	60,000.00	60,000.00
Bankhead-Jones	None	114,926.08	114,926.08
For Bankhead-Jones Offset			367,483.14

EXPENDITURES

Purpose	Fund			
	Hatch	Adams	Purnell	Bankhead-Jones
Personal Services:				
Administration	12,653.85			
For all other purposes		12,839.84	46,179.38	87,788.91
Travel	394.24	374.04	3,560.28	3,441.61
Transportation of Things	12.03	12.95	15.01	242.56
Communication Service	86.89	16.71	299.58	326.33
Rents and Utility Services:				
Heat, light, power, water, gas, electricity	35.00		21.32	101.18
Rent of space in buildings or equipment			665.00	212.85
Rent of land				577.00
Printing and Binding:				
Printing publications	630.00		139.35	109.38
Other printing, and binding	1.25		94.71	133.64
Other Contractual Services:				
Repairs and alterations to equipment and other contractual services not otherwise classified	216.26	220.46	649.44	2,346.43
Repairs and alterations to buildings (not capital improvement)				754.90
Supplies and Materials:				
Used in construction, repair or or alteration of buildings	7.69			3.16
Other supplies and materials	715.73	1,225.79	5,929.59	8,748.31
Equipment	247.06	310.21	2,446.34	9,391.27
Lands and Structures (Contractual):				
Buildings (Capital improvements including purchase, erection, repairs, and alteration), and fixed equipment				748.55
TOTAL EXPENDITURES	15,000.00	15,000.00	60,000.00	114,926.08

NON-FEDERAL FUNDS

Fiscal Year Ended June 30, 1946

FUNDS AVAILABLE

	For All Purposes	For Agricultural Investigations
State appropriations or allotments:		
Main station	$298,019.21	$283,186.81
Sales	47,199.03	47,199.03
Miscellaneous: Commercial Gifts	18,778.29	18,778.29
Balance brought forward from previous year (all sources)	18,319.01	18,319.01
TOTAL	382,315.54	367,483.14

CLASSIFICATION OF EXPENDITURES FOR AGRICULTURAL INVESTIGATIONS

Personal Services	$ 200,344.79
Travel	10,497.14
Transportation of Things	855.35
Communication Service	3,392.00
Rents and Utility Services	4,320.75
Printing and Binding	3,614.36
Other Contractual Services	12,576.11
Supplies and Materials	39,188.79
Equipment	37,576.60
Lands and Structures (Contractual)	23,989.85
War Bonus	11,672.56
TOTAL EXPENDITURES	348,028.30
Unexpended balance	19,454.84
TOTAL FUNDS AVAILABLE	367,483.14

THE AGRICULTURAL EXPERIMENT STATION
OF THE
NORTH CAROLINA STATE COLLEGE OF AGRICULTURE AND ENGINEERING
AND THE
BUREAU OF AGRICULTURAL ECONOMICS
UNITED STATES DEPARTMENT OF AGRICULTURE, COOPERATING
L. D. BAVER, DIRECTOR
STATE COLLEGE STATION
RALEIGH
